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1948 Iron Foundries Census of Production

The Government and the industry have expended very considerable time and money in assembling data for the production of the Report on the Census of Production for 1948 (Iron Foundries).* It thus behoves everybody in the industry to get what benefit they can from it. Table 1 gives the overall picture of the larger establishments and, where possible, makes a comparison with 1937 and 1935. This part of the industry (in 1948) employed 118,942 and produced castings to the value of £113 million. It spent £46 million in raw materials; paid out £41 million in wages and salaries and carried on its activities in 870 establishments. Table 2 tells us that an additional 195 small foundries (ten or fewer than ten employees) employed 1,269 people. Table 3 is included for making a final summation of employment and adds on a further 400 for firms not making a satisfactory return. The total now reaches 120,611 as against nearly 160,000 to-day. The major lesson to be gained from Table 4 is that firms employing between 200 and 300 people had the highest net output per person employed (£620) whilst the very largest, at £516, make the worst showing. Even the 11 to 25 group returned £578. The group which had the highest gross output was the 100 to 200 class. The next few tables break up the industry according to the nature of their output, giving such information as quantity and value. Table 12 deals with the export side of the business, mainly confined to pipes, builders' castings, hollow-ware, and malleable cast-iron fittings.

Table 13 tells the world what a great buying capacity exists within the foundry industry and details just how the £46 million was spent. It reports the purchase of £15 million of pig-iron; £3½ million of scrap; £476,000 worth of ferro-alloys and the like; 54,000 tons of limestone and fluorspar; 1,700 tons of soda ash; 677,700 tons of moulding sand; £891,000 worth of various bonding materials; 50,000 tons of firebricks; 3,200 tons of moulding boxes; 600 tons of grinding wheels; and 100 tons of welding rods! The second half of the table records the purchase of 628,400 tons of coke, 337,200 tons of coal, and the quantity and cost of gas, electricity, and oil fuel.

Table 14 details stocks—a matter of little interest to-day—whilst the next one shows the spread of the wages bill between male and female, under and over eighteen, and those of the staff. Table 17 just states that the total amount paid out for work done on materials given out was £1,048,000; Table 18 records something of service payments for the industry. For instance, it spent £79,000 on newspaper advertising and £28,000 on other forms of publicity, but there is an " unclassified " entry under this head of £129,000. For research and consulting fees there was an expenditure of £100,000, about half the money paid for postal services. Another table tells us that only £932,000 was spent on building work. The final tables must be for Government use, as they split up some of the returns geographically as between Scotland, England, and Wales. We regret we can draw no conclusions from this mass of figures, unless it be either to recommend firms to augment or diminish their manufacturing activities to the two ranges cited—which is ridiculous.

* Final Report on the Census of Production for 1948, vol. 3, Trade C Iron Foundries, published by Her Majesty's Stationery Office. Price 3s. 6d. net.

American Society for Testing Materials

50th Anniversary Meeting

At the 50th anniversary meeting of the A.S.T.M. in June, at the Hotels Statler and New Yorker, in New York City, U.S., there were presented 165 papers in some 40 formal and informal technical sessions and 70 reports from the technical committees. The unusually strong technical programme arranged to commemorate the society's formal incorporation as a national technical society in 1902, together with the 450 technical committee meetings and the society's largest exhibit of testing apparatus and scientific instruments, attracted a record-breaking number of engineers and materials men totalling 2,606. The official registration does not include large numbers of men attending sessions and visiting the exhibits, or the ladies, who totalled about 275.

As a result of recommendations in the some 70 committee reports at the meeting, 75 new specifications and tests were approved for publication for the first time. Most of the committees have concentrated during the first half of this year in revising their standards so that they would be up to date for the new 1952 edition of the book of A.S.T.M. Standards to be issued later this year, and in reviewing tentatives to be adopted as final standards. Some 90 existing proposals were recommended for adoption as formal standards subject to Society Letter Ballot. Also there are about 270 standards and tentatives in which revisions are to be incorporated.

Marburg and Gillett Lectures

Two outstanding lectures were presented during the meeting, one on "Non-destructive Testing," by DR. R. C. MCMASTER, Battelle Memorial Institute; the other by NORMAN L. MOCHEL, manager, metallurgical engineering, Westinghouse Electric Corporation, on "Man, Metals and Power." In his Marburg lecture Dr. McMaster stressed the importance of evaluating materials by non-destructive means, with such tools as the X-ray, magnetic particles, ultrasonic, and others. In the first lecture commemorating H. W. Gillett, one of the country's leading metallurgists, Mr. Mochel outlined many of Dr. Gillett's notable accomplishments and reviewed the significance of metals in connection with production of power. Many other papers were presented in the 40 sessions held during the meeting, which included 23 technical symposia.

New Officers

Dr. Harold Lee Maxwell, supervisor of mechanical engineering consultants, E.I. du Pont de Nemours & Co. Inc., Wilmington, Del., was elected president for 1952-53, succeeding T. S. Fuller, engineer in charge of works laboratory, General Electric Company, Schenectady, N.Y., who continues on the board of directors as past-president for three years. Norman L. Mochel, manager, metallurgical engineering, Westinghouse Electric Corporation, Lester Branch P.O., Philadelphia 13, Pa., is the new vice-president.

(*Continued at the foot of Col.* 2)

Conference Paper Author

Mr. G. A. Lillieqvist is the author of the exchange paper from the American Foundrymen's Society entitled "Rôle of the Research Foundry Unit," printed on the adjoining pages. He was born in London in 1894, but spent most of his early life in Switzerland. In 1924 he graduated with a Ph.D. degree in chemistry from the University of Berne, and in the same year he went to America. He joined the American Steel Foundries as a chemist at the Granite City Works, nr. East St. Louis, and three years later was transferred to the research laboratory at the Indiana Harbour Works. From 1927 to 1941 he was this organization's research metallurgist, and was promoted to the position of chief metallurgist and assistant works manager in the latter year. In 1943 he was appointed research director. Mr. Lillieqvist is the author of a number of important technical papers, and in addition to being a member of the majority of the American metallurgical societies, he is a member of the British Iron and Steel Institute. He is also a member of the Metallurgical Advisory Committee on Cast Armour and of the Technical Subcommittee of the Munitions Board.

Forty Years Ago

Our August issue of 1912 contains an account of the Ford foundry at Detroit. It was 201 ft. long by 148 ft. wide, but was being extended to 401 ft. The moulds were machine made, and labour was broken down to give each man a simple task. In this floor space of 12,000 sq. ft., 7,000 castings were made in one day and at the rate of 18 per man, including every type of labour. Except for the absence of conveyors and a modern sand-preparing plant, the illustration shows the plant to be thoroughly workmanlike. Amongst the business notes it is recorded that the Manchester Engineers' Club had been formed.

AS PART of the celebration of their centenary year, Glenfield & Kennedy, Limited, hydraulic engineers, Kilmarnock, last week gave each of their 2,500 employees an extra week's wages and their 126 pensioners an extra week's pension.

The new members of the board of directors are as follows:—George R. Gohn, supervisor, creep and fatigue laboratories, Bell Telephone Laboratories, 463, West Street, New York, N.Y.; William H. Lutz, technical director, Pratt & Lambert Inc., 75, Tonawanda Street, Buffalo, N.Y.; Howard K. Nason, research director, organic chemicals division, Monsanto Chemical Company, St. Louis, Mo.; Adolph O. Schaefer, vice-president in charge of engineering and manufacturing, The Midvale Company, Nicetown, Philadelphia 40, Pa.; and Myron A. Swayze, director of research, Lone Star Cement Corporation, 100, Park Avenue, New York, N.Y.

Rôle of the Research Foundry Unit*

By G. A. Lilliegvist

Lower cost and improved performance, achieved through research, are the parents of the famed American living standard. Every improvement contributing to the comfort, ease and convenience of daily life has its origin in invention and development. There is no alternative and this holds true for all industries including the great foundry industry. The world's progress will depend to a great extent on developments in research laboratories. Advances in living will come through new processes, new products and new opportunities achieved through research. Without freedom, all research, be it fundamental, be it applied, will falter and progress toward greater things will stop. Many words have been used to define research, to differentiate between fundamental, scientific, applied and industrial research. It is not the Author's intention, however, to discuss the merits of the several kinds of research. In the foundry industry, the methods and procedures used to solve problems are not of primary concern. The end result is all important. However, it must be recognized that all applied or industrial research projects originate from fundamental or scientific research. Therefore, both types of research are of extreme importance for the continued development of new processes and new products. In general, fundamental research is being carried out by universities and various research foundations, while applied research is being concentrated upon by industry, and the question arises as to what contributions research has made to the foundry industry. The answer to this question gives the Author his subject.

Organization

Officials of American Steel Foundries visualized the necessity and great importance of research in the year 1926, when they made the decision to organize a research laboratory at East Chicago, Indiana. This laboratory was mainly to be utilized as a tool for applied research to assist in the advancement of the steel-casting industry from an art to a science. A wise decision it was indeed! As it can well be realized the organization was very small in the beginning, consisting of two technically-trained college men and a machinist. To-day, the organization has grown to 30 men, of whom 11 are college-trained men from various universities; and 19 non-technical people, such as machinists, foundry helpers, chemists and induction-furnace melters. There is no doubt that the organization will continue to expand.

The present organization is illustrated in Fig. 1. It is of interest to note that the research director reports to the vice-president in charge of the manufacturing division who reports directly to the president of the Company. The organization is divided into three sections; foundry, melting, and cleaning and finishing. Each section is directed by a department head and two assistants, both of whom are university graduates either in chemical or metallurgical engineering. It might be asked, " Why is it necessary to have two assistants in such a small organization?" The answer is obvious. To-day in the foundry industry there is a very real and very serious shortage of a precious national resource—research workers. To obtain more of them industry must train them. To maintain leadership, no phase of research can be of greater importance than to train young workers.

Liaison with Production

There is another important phase of research and that is " how to utilize research and how the information is given to the manufacturing plants." True enough, reports are written and transmitted to the works, but this in the Author's opinion is insufficient. New methods, new processes, new applications must be discussed *pro* and *con* and, therefore, as will be noted from Fig. 1, there is a contact man at each one of the plants with whom the various subjects can be discussed. The Author is indeed proud to report that several of these contact men had some of their training at the research laboratory.

The contact man in turn reports the findings to the respective works managers and if favourably accepted, plant experiments are outlined. The contact man co-ordinates the various experiments and reports the results to the respective works manager and the research director, who in turn reports the findings to the vice-president in charge of the manufacturing division. A decision is then made whether or not the new process should be adopted as standard practice.

Another question, no doubt, comes to mind.

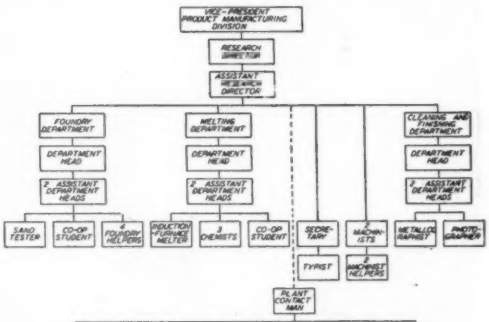


FIG. 1.—*Organization Chart of the American Steel Foundries' Research Department.*

* Official Exchange Paper from the American Foundrymen's Society presented to the Buxton Conference of the Institute of British Foundrymen.

Table I.—Outline of Activities of Each Section of the Research Laboratory.

A. Foundry Department Responsible for—

1—New materials for patterns.
2—Moulding-sand mixes.
3—Core-sand mixes.
4—Reclamation of sand.
5—Core-blowers.
6—New binding materials.
7—Mould and core washes.
8—Sand-testing.
9—Acceptance tests for various materials.
10—Heading and gating.
11—Use of chills, cracking strips, etc.
12—Pouring of moulds.
13—Setting up quality-control charts.

B. Melting Department Responsible for—

1—Principles of induction-furnace operation.
2—Principles of electric-furnace operation.
3—Principles of open-hearth furnace operation.
4—Methods of charging.
5—Temperature control.
6—Deoxidizing practice.
7—Ladle practice.
8—Pouring-temperature control.
9—Chemical analysis of steel and other materials.
10—Specifications.
11—Setting-up quality-control charts.

C. Cleaning Department Responsible for—

1—Removal of gates and heads.
2—Removal of defects.
3—Blasting.
4—Welding.
5—Grinding.
6—All types of heat-treatment.
7—Physical testing.
8—Non-destructive testing.
9—Straightening.
10—Investigation of casting failures.
11—Specifications.
12—Setting-up quality-control charts.

Table II.—Method of Classifying Research Laboratory Projects.

Project I—Process development.
A—Steel castings.
1—Melting.
2—Foundry and coreshop.
3—Cleaning and finishing.
4—Inspection.
Project II—Product development.
A—Steel castings.
Project III—Service work for plants.
A—Steel castings.
Project IV—Service failure investigations.
A—Steel castings.

"What are the duties of the departmental heads of the various sections?" In Table I (A, B and C) lists of their duties are recorded.

No small list indeed! And it is, of course, humanly impossible to work at any one time on all these subjects. Furthermore, many problems arise in a steel-castings foundry, when experiments will have to be made at the plant and cannot be carried out in the laboratory. Reference is made, for instance, to certain melting units, to gating and heading practices of larger complicated castings and to removal of larger defects. The personnel of the research laboratory must acquaint themselves with these methods and procedures so that they can be of assistance and make recommendations to the several plants.

Table III.—Method of Reporting on Research Projects.

1—The heading of each report will include the project number, the title of the project and the specific work being reported.
2—Abstract.
3—Object of investigation.
4—Summary and conclusions.
5—Recommendations.
6—Details of investigation including discussion of the results obtained.

Finally, how are the records of the various experiments kept, and how are the results reported to the various interested parties? The various projects are divided into four classifications as shown in Table II. All reports are written in the manner as shown in Table III. These reports have been well received because a "busy" man needs to read only the abstracts in order to be informed what has been accomplished. Of course, the contact man and other parties especially interested in a particular field read and study the complete report. During the fiscal year of 1951, from September, 1950, to September, 1951, 196 reports were submitted: 109 reports or 55 per cent. were for process development, 55 reports or 28 per cent. for product development, 24 reports or 12 per cent. for service work for the various plants and 8 reports or 5 per cent. for service failure investigations.

Finance and Committee Work

How is the research laboratory being maintained financially and who bears the "burden"? The Author is pleased to report that he has no worries, whatsoever, as he has no fixed budget. Apparently the officials of the Company believe that the cost of operating the research laboratory is more than offset by the benefits obtained. Additional evidence of their willingness to absorb research cost is indicated by the substantial funds recently allotted to expand the facilities further.

One other point which might be of interest to members, although only indirectly related to research, is the committee work within the Company. Besides the various activities of societies such as the American Foundrymen's Society, the Steel Founders' Society of America, American Society for Metals and American Institute of

FIG. 2.—*Main Research Shop housing Furnaces, Lathes, etc.*

FIG. 3.—*Experimental Foundry at the American Steel Foundries Concern.*

Mining and Metallurgical Engineers, officials of the American Steel Foundries Company have organized various committees within the concern. Such committees are the open-hearth committee, the electric-furnace committee, pattern-standardization committee, core-blower committee and the general inspection committee with various sub-committees such as X-ray, Magnaflux, etc. At least once a year, the interested parties at the several plants meet and discuss problems of mutual interest, relate their experiences, discuss research laboratory projects and outline future experiments. This work has been of outstanding benefit to the Company. The chief executives are very encouraged and are contemplating additional committees.

Research Laboratory Layout

Before proceeding with certain projects which have been carried out at the research laboratory, two illustrations of the present layout and equipment are included. Fig. 2 shows the main shop in which are located two induction furnaces, heat-treating furnaces and a completely-equipped machine-shop for the preparation of test specimens. Fig. 3 shows a partial view of the experimental foundry including a moulding machine, shot-blasting equipment, burning-off machine and a core-blower. In addition, there is a fully-equipped chemical laboratory, including the latest type of spectroscope, a physical-testing laboratory, microscopic laboratory and a sand-testing laboratory. As in all laboratories, the library consists of the various transactions of the most important societies' various trade magazines, such as the FOUNDRY TRADE JOURNAL and the *Journal of the (British) Iron and Steel Institute*. Needless to say, it is beyond the scope of this Paper to detail all the instruments with which a research worker carries out his assignment.

Temperature Measurement and Fluidity

In the last few years, a large amount of research work has been done in Great Britain and the U.S.A. on temperature measurement and the influence of

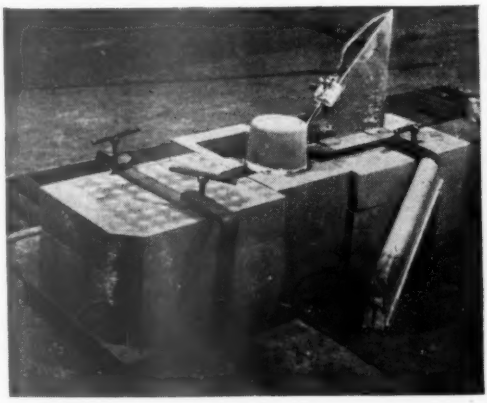


FIG. 4.—*Set-up for Fluidity Testing. All Parts are made in Core-sand.*

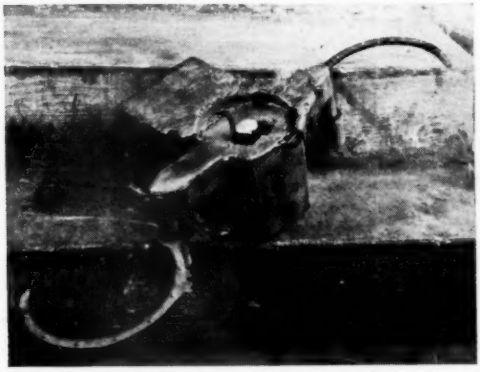


FIG. 5.—*Fluidity Test Casting in Steel.*

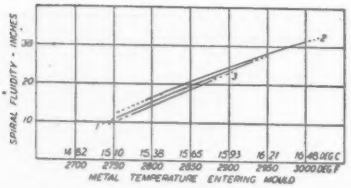


FIG. 6.—*Relative Fluidity of Steel according to Temperature for Various Melting Processes;* (1) *Induction-furnace Steel,* (2) *Acid Electric-furnace Steel,* (3) *Basic Open-hearth Steel.*

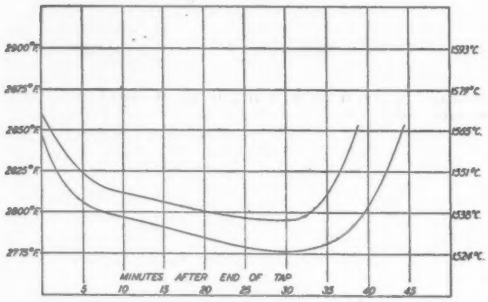


FIG. 7.—*Metal Temperature as a Ladle of Steel was emptied by Bottom Teeming.*

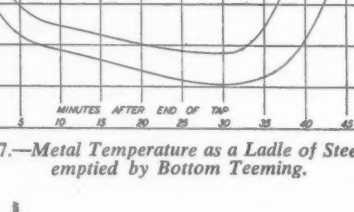


FIG. 8.—*Influence of Temperature on the Incidence of Misruns and Cold Shuts.*

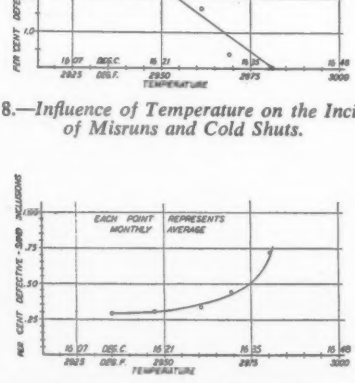


FIG. 9.—*Influence of Steel Temperature on Sand Inclusions.*

temperature on the fluidity of steel. It is impossible in this discussion to make reference to all the valuable papers which have been published. However, the Author would like to pay tribute to Mr. J. F. B. Jackson, director of research, of the British Steel Founders' Association, Research and Development Division, who so kindly presented an excellent

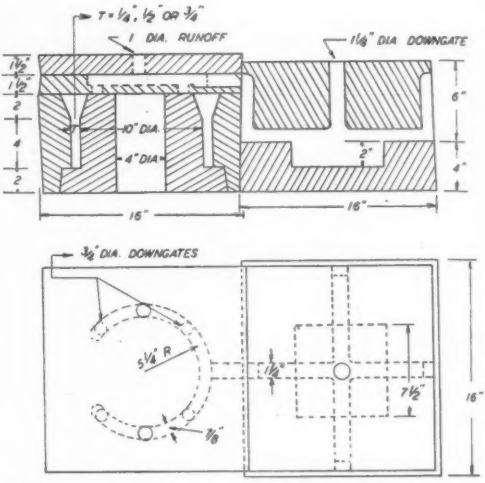


FIG. 10.—*Core Assembly for Investigation of Hot-tearing. Gating System is so arranged that One to Four Castings can be Poured.*

exchange paper before the electric-furnace steel conference of the American Institute of Mining and Metallurgical Engineers in December, 1949, on the subject of "Temperature Measurement and Temperature Control in Steel Foundries."[1] It can be said that due to British leadership in this field, an outstanding amount of progress has been made in the U.S.A. All foundries of the American Steel Foundries Group, be they basic-open-hearths, acid or basic electric-furnace shops, are equipped with immersion-types of instruments, either of the platinum/platinum 10 per cent. rhodium, the Rayotube or the photo-electronic equipment. The superintendents and melters rely on such tools to assist in producing a quality product.

Instead of setting out a long list of publications and references, it is proposed to relate experiences and findings with temperature measurement and the relation—influence of fluidity to temperature. In Fig. 4 the fluidity test mould assembly, built of cores, is illustrated. A 32-gauge platinum/platinum

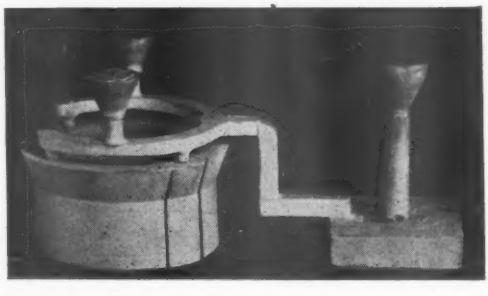


FIG. 11.—*Hot-tear Test Casting for Steel, with Runners, etc., Attached.*

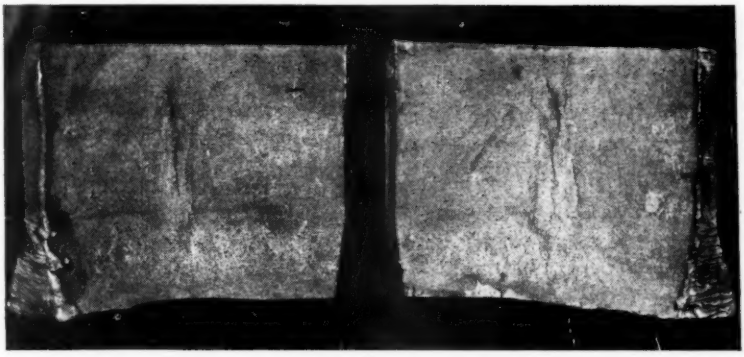


FIG. 12.—*Rating No. 1 for the Hot-tear Defect in Steel.*

10 per cent. rhodium thermocouple is inserted at an angle of 45 deg. into the pouring-cup and is shielded by a fused-quartz tube 6 in. long, 4 mm. o.d. and ½ mm. wall thickness. Accurate pouring temperatures can be obtained by this method if the pouring of the steel is continuous for a period of 7 to 12 secs. The resulting fluidity test-casting is shown in Fig. 5. The large reservoir and how the steel enters the downgate and hence into the spiral on both sides should be noted. This casting weighs approximately 90 lb. and the reservoir has been provided in order to control the rate of feeding the spirals. Very satisfactory results have been obtained at various mould-entering temperatures from induction-, acid-electric, and basic-open-hearth furnace steels of the plain carbon composition, as shown in Fig. 6.

The highest fluidity was obtained from the acid-electric-furnace steel which had the highest sulphur content, namely, 0.040 per cent. In the Author's opinion it clearly demonstrates that from a practical viewpoint, the mould-entering temperature is the most important factor in the control of the property "fluidity." In spite of all the experiments which have been carried out in the two countries, it is a well-known fact that foundrymen disagree with metallurgists on this subject. Foundrymen place emphasis on other factors, the most important one of which is the rate of pouring the various moulds. It must be said at this point that the proper pouring of a mould is a difficult and most-important task and should be given more study. Perhaps some method to reduce the human element may be found.

Some interesting and enlightening experiments have been made at one of the associated basic-open-hearth plants. The temperature of liquid steel in a 30-ton ladle approximately 9 in. above the nozzle was determined from the beginning to the end of the pouring operation. It was interesting to note from Fig. 7 how the temperature of the liquid steel increased at the end of the pour. This gave the industry valuable information, as it was always claimed in the past that light-section castings should be poured at the beginning of the heat. Fluidity-tests as described have also been made at various positions of the pouring operation and found to directly relate to temperature. Additional valuable information was obtained from accurate reliable temperature measurements; for instance, Fig. 8 illustrates the influence of temperature on misruns and cold-shuts and Fig. 9 the effect of sand inclusions. As expected, a low temperature will result in misrun castings and a high temperature in erosion and sand-inclusions. A full session could be devoted to this subject, but due to the nature of this Paper discussion must be limited.

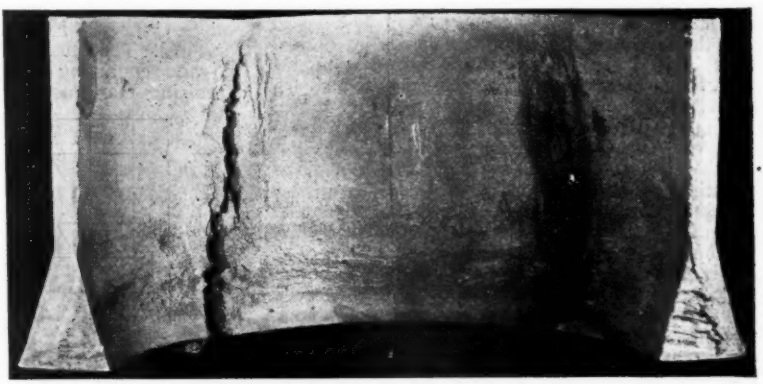


FIG. 13.—*Rating No. 8 allocated to Very Severe Hot-tearing.*

GRADE-B STEEL
½ IN. THICK CASTING
0.060 SULPHUR
0.045 SULPHUR
0.035 SULPHUR
0.025 SULPHUR
HOT-TEAR RATING
TEMPERATURE OF STEEL ENTERING MOULD
2750 2800 2850 2900 2950 3000 3050 3100 DEG. F.
1510 1538 1565 1593 1621 1648 1677 1704 DEG. C.

FIG. 14.—*Relationship between Hot-tear Rating, Steel-entering Temperature, and Sulphur Content.*

Factors Affecting Hot-tears

Ever since steel castings have been made, the problem of hot-tearing has been encountered and many investigations have been made in both countries better to understand and eliminate this detrimental defect. Many valuable papers have been written on this subject and reference is made to the splendid British papers by Mr. H. F. Hall who determined "The Strength and Ductility of Cast Steel during Cooling from the Liquid State in Sand Moulds"[2] and the more recent one by Mr. J. M. Middleton and Dr. H. T. Protheroe on the "Hot-tearing of Steel,"[3] and in America to the work by Mr. C. W. Briggs and B. Gezelius on "Studies on Solidification and Contraction in Steel Castings."[4 5] In this report, no useful purpose is gained by referring to all the contributions which have been made. Members are, no doubt, more interested to know how the American research organization is studying this problem and what has been accomplished.

The phenomenon of hot-tearing in steel castings is indeed very complex as so many factors enter into the picture, such as the chemical composition of the steel, the mould-entering temperature, and, probably most important, the proper adjustment of the sand- and core-mixes. At the present time, the occurrence of external hot-tears has only been studied by the Author's concern as it is believed that they are of greater importance than the internal ones. After many investigations to find a suitable test-casting to evaluate the sensitivity and reproducibility of hot-tearing, the core assembly shown in Fig. 10 has been selected. This casting has a ½-in. wall-thickness and an approximate inside diameter of 10 in. There is no doubt that other just-as-satisfactory test-castings may be designed, but for domestic purposes the one selected gave valuable information. In Fig. 11 the as-poured casting weighing approximately 95 lb. is shown. The casting is poured through the downgate into a fairly-large reservoir, the liquid steel rising into another gate and then into the ring-gate which has four small finger-gates for feeding the casting. To obtain the mould-entering temperature, a platinum/platinum 10 per cent. rhodium thermocouple is inserted into the pouring cup in a similar manner as in the fluidity-test experiments. Note the pads on the outside of the casting, which are 2 in. wide, ½ in. thick and run the entire height of the casting. These pads are for the purpose of creating a hot-spot at this particular location and are in part responsible for the occurrence of hot-tears.

The problem next arises how to evaluate the severity of hot-tears. As a personal opinion, there is no better way to illustrate this than by pictures. If, after a severe, hot-hydrochloric-acid etching test for 20 min., the casting shows no evidence of hot-tears or external cracks, the hot-tear rating has been designated as No. 0. If the casting shows slight cracks as shown in Fig. 12, the hot-tear rating is No. 1. The hot-tear rating number is progressively increased as the cracks become progressively more severe. In other words, a hot-tear rating standard has been established and serves as a basis of comparison for future evaluation. This method of evaluation has been of extreme help. With very-severe cracks as shown in Fig. 13 the rating is No. 8.

The important question now arises: "What has been accomplished with this test-casting?" During the period of two years preceding the writing of this report, 60 progress reports have been prepared on such factors as chemical composition, deoxidation practice, pouring rate, mould-entering temperature, variation in core-sand mixtures, variation in grain-size, grain-shape and grain-distribution and many other factors. Space will not permit the Author to cover all these factors but two are illustrated. It is a well-known fact that increasing sulphur content in steel increases the occurrence of hot-tears and this is shown in Fig. 14. At mould-entering temperatures of 2,800 deg. F. (1,535 deg. C.) and a sulphur level of 0.025 per cent., the hot-tear rating number is 0 to 1, at a sulphur level of 0.035 per cent. it is number 1. At 0.045 per cent. S., the rating number is 3 to 4 and finally with 0.060 per cent. S., the number is 7. It is of interest to note that at an approximate mould-entering temperature of 2,950 deg. F. (1,620 deg. C.), the hot-tear incidence decreases very sharply, no doubt due to the fact that the cores collapse very rapidly at these high temperatures. All the experiments were made from induction-furnace heats of plain medium-carbon steel of the following nominal percentage composition:—C 0.27; Mn 0.70; Si 0.40; P 0.015, and S as indicated. The deoxidation practice was in all cases the same, consisting of 2½ lb. of aluminium and 3 lb. of calcium-manganese-silicon per ton of charge.

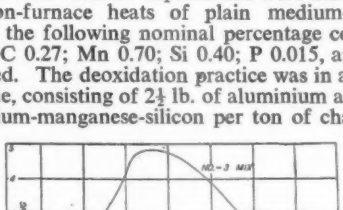


FIG. 15.—*Effect of Three Sand Mixes on Hot-tear Occurrence in Grade-B Steel.*

The other factor, that of the effect of core-sand mixtures, on the hot-tear occurrence is illustrated in Fig. 15. Core-sand mix No. 1 has the greatest collapsibility and consequently has the lowest hot-tear rating. Core-mix No. 2 has an intermediate collapsibility and intermediate hot-tear rating, while mix No. 3 is the strongest of the three mixes with the highest hot-tear rating. In all of the subsequent work, the laboratory used the core-mix No. 2 for comparative purposes and investigated such metallurgical and foundry factors as are listed below:—

Metallurgical Factors :

1. Influence of mould-entering temperature.
2. Influence of C, Mn, Si, Cr, Ni, Mo and combinations thereof.
3. Influence of phosphorus and sulphur.
4. Influence of deoxidation practices, with small and large amounts of aluminium, titanium, selenium, and Mischmetal.

Foundry Factors :

1. Influence of sand grain-fineness.
2. Influence of grain-shape.
3. Influence of grain-distribution.
4. Influence of various binder additions.

Each of these factors could constitute a separate paper and, therefore, will not be discussed further.

(To be continued)

Parliamentary

Water Pipes

MR. BOSSOM asked the Minister of Supply if he would make further endeavours to overcome the shortage of 3-in., 4-in. and 6-in. iron or asbestos water pipes, so as to prevent a situation which would result in considerable stoppage of the housing programme throughout the country.

In reply MR. SANDYS said that, as a result of arrangements which had already been made, production of 3-in. and 4-in. cast-iron pipes was increasing substantially. Additional labour was being recruited to enable the output of 6-in. cast-iron pipes to be expanded also. He was informed by the Minister of Works that arrangements had also been made to step-up substantially the production of asbestos cement pipes.

Sierra Leone Iron-ore Exports

When SIR RICHARD ACLAND asked the Secretary of State for the Colonies what was the reason for the non-disclosure of the value of exports of iron-ore and diamonds from Sierra Leone, MR. OLIVER LYTTELTON pointed out that, under the arrangement made in 1950, these figures were not published because they would reveal the trading position of individual commercial concerns.

SIR R. ACLAND: "Would there be any harm in that? It is worth running a slight risk in order that we may know these most important figures."

MR. LYTTELTON: "I am not quite satisfied with this position. I am looking into it."

Iron-ore Research

Replying to MR. H. NICHOLLS, who asked the Minister of Supply what research was taking place into the improvement of quality of home-produced iron ore, as distinct from research into the production of iron and steel, MR. SANDYS said that the iron and steel industry had for many years carried out extensive research of this kind, and it was actively continuing.

Swedish Steel and Engineering Prospects

Although the Swedish consumer-goods industries are affected by marketing difficulties, and their production during the first four months of this year dropped by 6 per cent. compared with the corresponding period of 1951, the industries manufacturing capital goods report a 5 per cent. increase, and the production level of industry as a whole has remained largely without change.

The quarterly review of the "Skandinaviska Banken" states that there are favourable prospects for the iron-mining and metal industries, including the engineering industry. There is a very pronounced demand for iron ore, and the large exporters of engineering products have maintained their position well. In the home market, there is still, as during the entire post-war period, a good demand for industrial as well as agricultural machinery. There have been indications of increasing difficulties in the export markets, but the industries in question can face a possibly diminishing demand with an order book equivalent to 16 months' production.

During the first quarter of the current year, the production of pig-iron amounted to 261,000 tons, a figure 26 per cent. above that for the corresponding period of last year. For other iron production, the average exceeded last year's by 13 per cent., and for steel the increase was 10 per cent. As a result of considerable expansion, the State-owned Norrbottens Järnverk will be able to increase its output of pig-iron to 200,000 tons annually.

Iron and Steel Developments in Mysore

Two electric furnaces each with a capacity of 100 to 110 tons of pig-iron per day are nearing completion at the Bhadravati Iron and Steel Works, Mysore, India. Claimed to be the first of their kind in India, they will take power from the Jog hydro-electric works. A third furnace is to be installed later. At present, charcoal is being used for smelting the ore.

Developments proposed at Bhadravati envisage a four-fold expansion of the output of the main products —pig-iron, steel, and cement—from the present figure of about 25,000 tons each to 100,000 tons each. Because abundant electric power is available side by side with minerals containing alloying elements, ferro-alloy manufacture would be extended to include ferro-chrome, ferro-manganese, ferro-vanadium, and ferro-titanium. The Planning Commission set up by the Government of India has already accepted these expansion programmes and given them top priority in its five-year plan of development to be completed by 1956.

Developing Norway's Mines

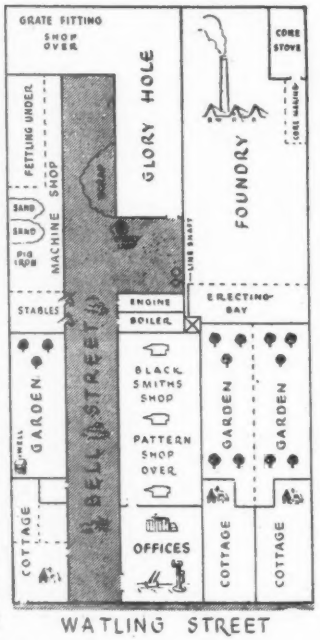
Proposals are before the Norwegian Storting for the allocation of 41,000,000 Kr. (£2,050,000) for mining purposes, of which £1,500,000 should be lent to A/S Sydvaranger iron mines, £165,000 should go for pyrites refining, £85,000 to research into the Vaddas pyrite deposits, £500,000 to build a research plant for the Dunderland ores, £150,000 for research and experiments, on Spitsbergen coal, £40,000 for Orsdalen wolfram and molybdenum mines, and £10,000 for examination of the nickel-bearing ores at Raana.

The support of the Mutual Security Agency is also sought in connection with the development of Norway's mining industry, and an indication of some $200,000 being granted by M.S.A. has been given.

Transition Piece

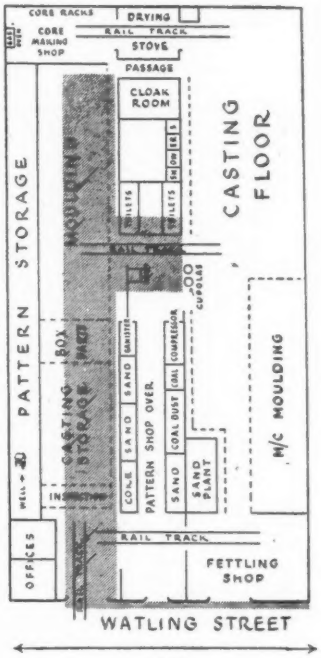
"Transition Piece" is the title of a small booklet issued by Goodwin Barsby & Company, Limited, of St. Margaret's Ironworks, Leicester, to mark the occasion of the 65th anniversary of their establishment. In this, they print the earliest layout and that of to-day and it is reproduced here. The area indicated by arrow lines is the present foundry frontage. The stipple area on the modern plan shows how Bell Street has "melted away." The foundry is now ventilated according to the latest Swedish advances, and generous provision has been made for washing and bathing. The walls are colour washed and a modern colour scheme for the plant and ironwork has been incorporated. Though many doubtless will deprecate the loss of the cottages, one must reflect that they were probably less sanitary than modern counterparts. No one, however, will mourn the "glory hole" and scrap pile and there could be no better "transition" than for these to turn into a foundry amenities block. With this booklet, was also received a copy of the eighth issue of their house organ the "Goodwin News." It is of larger format than is usual, and is designed to interest their own staff.

THE OLD



1887

THE NEW



1952

House Organs

Journal of Research and Development, June 1952. Published by the British Cast Iron Research Association, Alvechurch, Birmingham.

This issue carries two Papers, one on high-aluminium content cast iron by Mr. J. W. Bamfylde of rather specialized interest and a second one on carbon pick-up by Dr. H. T. Angus, which is of great general interest, because of the ever-increasing content of ash in foundry coke. This, as is well-known, acts adversely on carbon pick-up. In the southern hemisphere, where the ash content of foundry coke may range from 25 to 35 per cent., the problem of obtaining reasonably high carbon is an ever-present problem. The recommendations of Dr. Angus are so sensible that ironfounders should take advantage of buying scrap electrode rods whenever they are offered.

Albion Works Bulletin Vol. 6, No. 4. Published by John Harper & Company, Limited, Albion Works, Willenhall.

This bulletin starts with an article entitled "Further Outlook—Unsettled" and unhesitatingly we designate this as being the best editorial the reviewer has ever read in a works bulletin. There is the statement of fact, its implications and a clarion call for co-operative action, all written in plain good English. For the rest the usual picture is given of the trend of absenteeism—which is downwards; of the plant and process improvements being made, and of the firm's social and sporting activities.

Foseco Foundry Practice, No. 106. Published by Foundry Services Limited, Long Acre, Nechells, Birmingham 7.

This issue announces that it has been found necessary to re-name some of the products. Thus what were previously known as "grain-refiners" and "iron regenerator tubes" are now designated "Nucleants" and "Ferrotubes." A factor which has no doubt influenced this decision is universal suitability, for what sounds well in one language is totally unsuitable in another. As Foundry Services now rely on a world-wide business, this trade-marking becomes of ever-increasing importance.

Sif-Tips, Vol. 15, No. 78. Published by the Suffolk Iron Foundry (1920) Limited, Sifbronze Works, Stowmarket, Suffolk.

This issue announces the development of a new cast hard alloy for the building up of worn parts due to heat, corrosion and abrasion. It is known as Sifonite No. 18. Its use is shown in the re-tipping of cultivator points.

Production of Sound Castings*

By H. W. Griffiths

The aim of every founder is to produce 100 per cent. sound castings and the Author describes various means to this end, in relation to the several factors affecting foundry production. The main emphasis is on running and feeding methods, which are critically reviewed. The discussion which followed the Paper chiefly concerned exothermic material and Connor-block running.

The problem presented is by no means new, nor is it intended to give the impression that, after reading the Paper, one is certain to produce sound castings. Sound castings should be homogeneous, free from sinks and blowholes, and dimensionally correct. Very few foundries can guarantee the elimination of these defects, because of the many variables to be taken into account. These variables can be summarized as follow:—

First.—The pattern, which should of course be dimensionally correct, and have the necessary contraction allowance made. Furthermore, the material used should be in accordance with the number of castings required and the appropriate type of wood or metal should be used. Old patterns are frequently a source of bad castings. It is obvious, therefore, that a true pattern is one of the first essentials.

Secondly.—The metal, which, due to the mechanism of solidification, is always a contributory factor. For example, the amount of experiment and research put into the problem of producing sound ingots has been colossal. From this it can be seen what a wide field there is in the case of complicated castings made in all metals. In particular this is so when dealing with cast iron, with its varying types and composition.

If, for example, the simple case of a block of cast iron cast in a sand mould be taken, it can be seen from Fig. 1 that solidification takes place at the cool surfaces, and crystals, or dendrites, are formed. The "sink" formed is because the metal, which is drawn from the centre upper portion, fills the interstices of these dendrites as contraction takes place on cooling, leaving the hollow section in the top. The effect of a riser head is also shown. This sort of thing occurs in all castings, to some extent, depending on the design, sand, and metal used. It is with this in mind that one should make castings, and realize that unsoundness is more likely to occur at a change of section, or in large masses of metal.

Methods used to eliminate unsoundness of this nature fall under four main headings:—(1) Runner system; (2) chilling; (3) pressure feeding; and (4) feeder heads (with or without Thermit materials).

* Paper read before the West Riding of Yorkshire branch of the Institute of British Foundrymen. The Author is secretary of the branch.

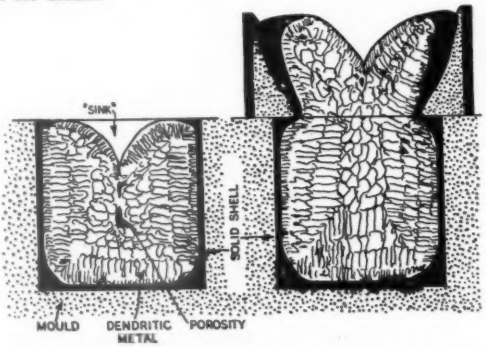


FIG. 1.—*Casting of a Simple Cube without and with a Feeding Head, showing the Effect of Shrinkage.*

Runner Systems

In choosing a runner system, the first consideration is to supply the mould with clean metal. This is done in various ways by means of different types of slag traps. (See Fig. 2.) The method of running a mould is largely dependent on:—(*a*) The type of metal; (*b*) the type of sand; (*c*) temperature of pouring; (*d*) fluidity; and (*e*) design of casting. The position of the riser, where necessary, will play a major part in the choice of the runner. Many shrinkage defects are due to varying rates of solidification throughout the casting. When the limit of effectiveness of the runner is reached, it will be necessary with certain castings to provide additional liquid metal to feed into shrinkage cavities. Feeding and running may be combined. A typical example for this is the "Connor" runner (Fig. 2 (*b*) and (*c*).

Certain jobs may be poured with a top ingate, the metal falling direct from the runner-bush into the mould. This application is mainly suitable for a mould where the metal will fall directly into the mould bottom. Very often this type incorporates a

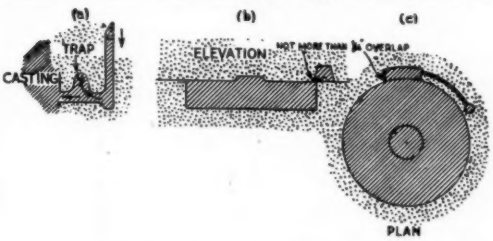


FIG. 2.—*Runner Systems, (a) Simple Form of Slag Trap; (b) and (c) Application of the "Connor" Runner to a Gear-wheel Blank.*

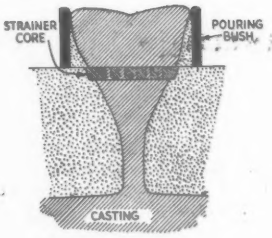


FIG. 3.—*Diagram showing the Use of a Strainer Core.*

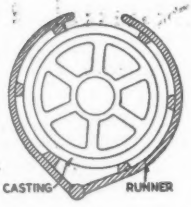


FIG. 4.—*Distribution Runner as applied to a Spoked-wheel Type of Casting.*

strainer core (Fig. 3). A circular casting, such as a handwheel, may be run with a distribution runner, which will avoid hot-spots due to the spokes (Fig. 4).

Chilling

In certain cases, denseners or chills may be used to prevent shrinkage. These may be in the form of a nail, with a large blob of metal at its head, which can be placed in small bosses where it is known that the casting is prone to shrinkage. Chills are useful in preventing hotspots caused by cores, etc., which absorb heat and quickly attain metal temperature. Slow cooling will occur at such points and rapid cooling at the sand surface, this state of affairs giving a tendency to liquid shrinkage. A typical example of the use of a chill is shown in an end-bearing casting which is machined in the bore. (See Fig. 5.) The use of a tellurium-wash has proved very useful in this connection. Much detail has been recently published on this subject. In the chilling methods it is felt that the porosity may sometimes merely be moved rather than eliminated.

Pressure Feeding

It is often necessary, due to a particular design of casting, to feed difficult bosses, etc., with liquid metal in order to prevent shrinkage. Here, pressure feeding mechanically forces the metal into the porous cavities. The pressure may be head pressure due to height of the feeding head, or addition pressure due, for example, to the atmosphere. The use of a shrinkage bob is successful for certain castings, a typical example being the case of a

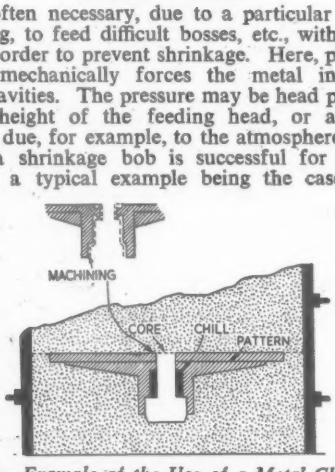


FIG. 5.—*Example of the Use of a Metal Chill for the Bore of an End-bearing Casting.*

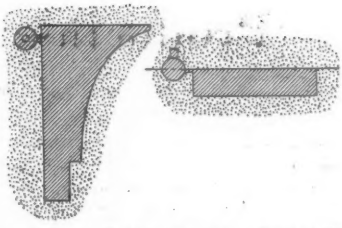


FIG. 6.—*Use of Shrink-bob for a Special Weight Casting.*

special weight casting as shown in Fig. 6. The use of a whirlgate, incorporating head pressure, has been quite successful for certain castings (Fig. 7). An improved form gives additional pressure due to the atmosphere by means of a pencil core, Fig. 7 (*b*), or a slot, in the head, Fig. 7 (*c*).

Pressure feeding by means of steam has been tried and found successful, for instance, on a simple case of a mould with a central runner and riser. The runner bushes are covered with flat iron plates or covers smeared with wet loam on the underside. The inner lip of the bush is machined to fit the cover plate. When the mould is poured the cover plate is placed on the runner bush and weighted. The two plates are placed simultaneously and weighted. The steam generated gives pressure to the head and this pushes liquid feed metal into the shrinkage cavities (Fig. 8). The use of this method is very limited and would be dangerous for general adoption.

Use of Thermit Material

Recent practice has been to try to keep the head-metal molten until after solidification of the casting has taken place. This may be done by various methods. A simple example of the protection of the surface of a feeder head is that of using straw for covering feeder heads in the steel foundry. A Thermit powder may also be sprinkled on the surface of the head. By use of a sleeve made of Thermit material it is possible to reduce considerably the amount of head metal necessary to feed a given casting. This is of particular advantage when very expensive metals are being cast. Where Thermit material is used, the exothermic action keeps the riser metal fluid and permits it to feed the shrinkage cavity. This is a vast improvement on the old method of feeding by means of a rod (Fig. 9) which was only partially successful. The success depended so much on the operator and more harm than good was caused by inexperienced men.

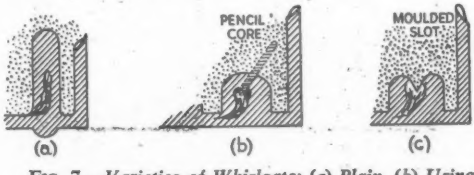


FIG. 7.—*Varieties of Whirlgate; (a) Plain, (b) Using a Pencil Core, and (c) Using a Vee Recess in the Top to Serve the Same Purpose as the Core.*

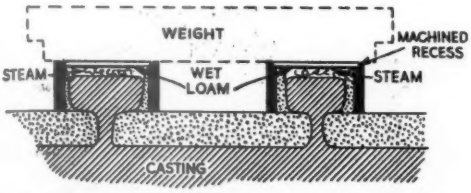


FIG. 8.—*Diagram illustrating the Method of Feeding by Steam Pressure generated from a Plate Coated with Wet Loam.*

Typical examples where Thermit sleeves are used are for large pinion wheels, rope drums, and ball castings.

Manufacture of Ball Castings

Solid, spherical castings of 6 in. dia., which are required to be mass-produced, are made in the following manner. The ball is used for sealing-off gas, and rests in a cup seating. Such castings must be perfectly sound over the surface, as they have to be machined before use. The centre of the casting must also be sound, as it has to be drilled and tapped. Originally, these balls were floor-moulded at a rate of six per day together with other jobs, but increasing demand now necessitates machine-moulded castings. From the moulding point of view the previous method of manufacture was similar to the more recent machine set-up, but the castings were rod fed (Fig. 9) from the riser. The resultant castings were inconsistent and often dirty. The ball pattern was mounted on a board and a Thermit sleeve used instead of an ordinary riser. It is then possible to pour the mould at any temperature, which is ideal for machine work, and 100 per cent. sound castings can be produced rapidly (Fig. 10).

The sleeve is made in a box and is similar in construction to a core. The material is mixed by hand with 5 to 10 per cent. water until the maximum bond is developed. Then, a ½-in. layer of core-sand is rammed down into the bottom of the core-box.

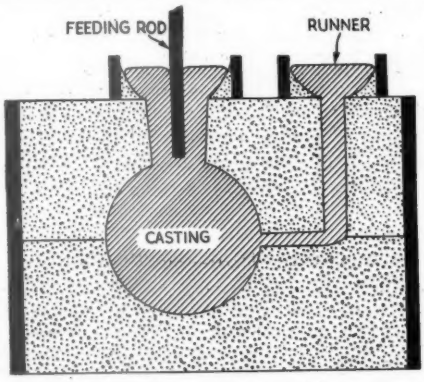


FIG. 9.—*Old Method of Rod Feeding from an Open-top Head as used for Spherical Castings.*

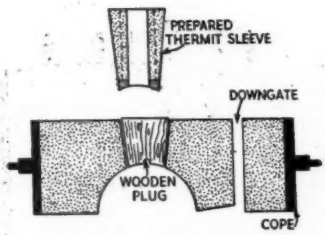


FIG. 10.—*Section through Half-mould showing the Method of Setting a Thermit Sleeve for a 6-in. dia. Ball Casting. A Wooden Plug is first Moulded and subsequently removed.*

This layer rests against the mould surface and prevents burning-in. The Thermit material is then rammed down until the box is full, after which it is strickled off and vented. The sleeve is then removed and dried at 200 deg. C. maximum for about one hour. It is protected from local burning by a metal or refractory shield such as a box-part. After drying, it may be handled freely. (See Figs. 11, 12 and 13.) It is beyond the scope of this Paper to discuss further any other factors which influence sound castings, but mention should be made of metal composition and condition, together with mould materials, etc., all of which have a very important bearing on the subject.

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[2] Paper No. 828, by F. G. Sefing. *I.B.F. Proceedings*, 1944-45, Vol. XXXVIII.

[3] "Chemical Chilling and Feeding," J. E. R. Tompkin, B.Met. FOUNDRY TRADE JOURNAL, Vol. 91, No. 1818, July 5, 1951.

DISCUSSION

MR. ANDERSON said the members were indebted to Mr. Griffiths for preparing a Paper at very short notice. Referring to the Thermit sleeve, he asked for information as to the thickness of the sleeve. Was it varied according to the thickness of the boss or the metal it was needed to replace?

MR. GRIFFITHS said the thickness of the sleeve varied with the maximum thickness of the casting. The necessity was to feed and the size could be worked out from a formula.

MR. KERSHAW, referring to the sleeves, said Mr. Griffiths rammed some core-sand at the bottom of

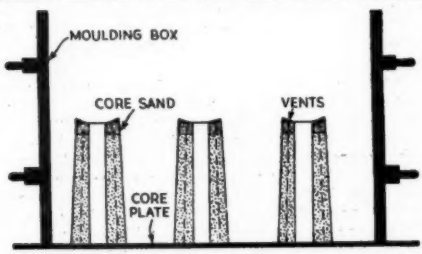

FIG. 11.—*Method of Arranging Protection for Thermit Sleeves during Drying at 200 deg. C. (shown in Section).*

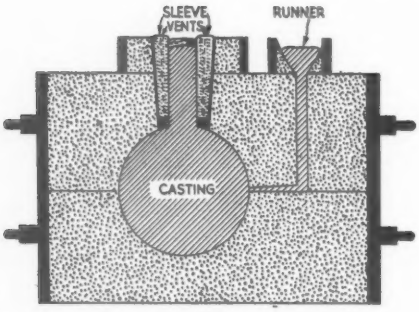

FIG. 12.—*Section through Mould Arrangement for Casting 6-in. Balls using a Thermit Sleeve.*

the sleeves. He, himself, had apparently used the same method by feeding a certain amount of sand between the casting and sleeve. When casting steel, some foundrymen used the sleeve directly against the casting. Had the Author tried that and with what results? The exothermic material after drying absorbed moisture rather rapidly, and he had noticed some " blowing " from the sleeve, that was, unless the sleeve was completely dried. He dried them in the oven at about 100 deg. C. and then inserted them in the mould. Even so, after only a matter of an hour or so there seemed to be a quantity of moisture present capable of causing " blowing."

MR. GRIFFITHS said he had tried making Thermit cores without sand and found it gave a bad surface to the casting. One could overcome that sometimes, because the ball casting was machined, but sometimes the defect was deeper than the machining allowance. The moulds for these castings were made in the morning and cast-up later in the day. If they were not well vented they would " blow."

MR. ANDERSON said he had had the same trouble and found that when the metal was entering the riser a slower pouring took the dampness out of

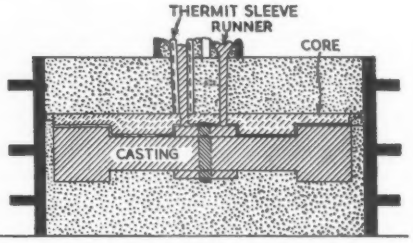

FIG. 13.—*Mould for a 46-tooth Wheel, using Thermit Feeder Sleeve on the Centre Boss (shown in Section).*

it and when the riser was full in most cases, the metal settled down very quietly.

MR. GRIFFITHS asked whether the sleeve was covered with iron when casting. If no such action was taken it could be the cause of the trouble.

MR. WILSON asked if the Author could say more about the " Connor " runner. He had tried making gear blanks with a single " Connor " runner which was not more than $\frac{1}{4}$ in. As a runner he used a rather heavy boss which did not appear to be fed by the sinking riser.

MR. GRIFFITHS said he illustrated a gear-blank casting because at one time he used a collar on it. With wheels of that size he did on occasion have some porosity in the centre and recently he had been using a sleeve on the spur-wheel and whilst it was successful for quite some time he had varied the number of runners on a casting. One essential feature was that there must be progressive solidification to the runner and the ingate must not be more than $\frac{1}{4}$ in. overlapping.

After this discussion Mr. Nicholls showed a film dealing with some phases of the grey-iron productivity team's Report and, at the conclusion of the meeting, votes of thanks were accorded to both Mr. Griffiths and Mr. Nicholls.

Abrasion-resistant Refractories

It is well known that bonded silicon carbide and fused-cast aluminium oxide are exceedingly abrasive resistant at very high temperatures, there being many applications in furnace work up to around 1,150 deg. C. Silicon carbide is formed at about 2,600 deg. C. and aluminium oxide fused at around 2,050 deg. C. Within recent years, both these materials have been used successfully in situations of severe abrasion, but where temperatures are relatively low. These include among other plant, blast furnaces and coke ovens. The subject was discussed by F. C. ROSE and HERBERT S. SCHROEDER in " Blast Furnace and Steel Plant," recently.

In the course of some general recommendations the authors state that for wear resistance under conditions such as exist in blast furnaces, either a fused-cast refractory or bonded silicon carbide is definitely indicated by overall economic comparison with other types of refractory materials. As temperature and other factors increase in severity, the use of these so-called superrefractories generally becomes more advantageous. Where there is high velocity impingement of gas-borne solids, either alone or in combination with direct abrasion, a silicon carbide lining is indicated. The wear resistance is essentially equal to that of fused-cast materials and is considerably cheaper; if thermal shock is involved, it is said to be the best refractory to use. In situations where the only action is direct sliding or rolling of sharp particles over a surface, fused-cast materials are the most wear resistant and should be selected provided thermal shock is not severe and cost is favourable.

Egyptian Iron-ore Project

Large-scale exploration work has been undertaken with a view to the exploitation of an iron-ore field in the region of El Kassir, in Egypt. Three large deposits have already been discovered, containing some 95,000,000 tons of ore. The Fe content varies between 40 and 60 per cent.

A company is to be formed, with a capital of £1,000,000 to exploit the deposits.

Aluminium Matchplate Patterns by the Pressure-cast Plaster Process*

Discussion of the Paper by Mr. E. C. Mantle and Mr. D. H. Potts.

Practical Hints

MR. B. N. S. PERRY (G. Perry & Sons, Limited), having made some matchplates in this country, mentioned one or two points not stressed in the Paper. The most important was that one could produce a plate only as good as the original patterns. Assuming the patterns accurate and had a smooth finish, the next important matter was that of finding a suitable parting agent. He had found that kerosine, stearic acid with a little aerosol (*i.e.*, wetting agent) appeared to be better than soap-solution and machine-oil. Also he had found that mechanical mixing of the plaster helped to maintain consistency from plate to plate, and that consistency had quite a bearing on the air bubbles entrapped in the mould.

In the drying of the moulds there seemed to be a likelihood of sagging, with the result that, if the moulds were not stoved together, one might get a plate of varying thickness. That could be surmounted by stoving the two half-moulds together to start with, until the moulds were quite hard, then parting them and carrying out the final and thoroughly drying of the two halves separately. A last and most difficult problem, which his Company had almost overcome, was to prevent the air in the receiver from following the metal down in the mould, which would result in the production of a plate with air-bubbles entrapped at the surface. He and his colleagues had encountered trouble because they used a diaphragm which was too strong and also a high air-pressure; it was found that if the metal temperature were too low, the air followed straight down the ingates and spoiled the plates. The use of a weak diaphragm and a minimum air-pressure helped considerably.

His experience was that there did not seem to be a very big sale for double-sided matchplates in this country, and he visualized that the demand would be for cope-and-drag plates with patterns and runners cast integrally. A foundryman, he concluded, expected a pattern to be produced very quickly, very cheaply and very accurately; and from his experience of American pressure-casting shops, that was possible. There he had seen plates made and delivered within 24 hrs., and the average time for making plates was four days.

MR. POTTS said Mr. Perry had contributed a useful survey and it was up to the foundries now to utilize the method described, if they considered that it was a cheaper and better method than they had used in the past. In his own view it was especially applicable in jobbing foundries and where many duplicates were required on a pattern-plate. Only one master pattern was required of the item to be produced, and it should be made to a very high standard. The method was capable of reproducing wood graining—that fact gave an indication of the definition that could be secured.

Mr. Potts was unable to give cost figures, but he had some information on times. He exhibited an aluminium core-box which he had had produced for purposes of illustration at the conference, though he did not regard it was a good example as he was rushed for time, and the core-box did not come out as well as he had expected. For this job, from the time of the receipt of the master pattern (and that was only a piece of wood of the shape of the core required), the core-box was made in three hours. One of the matchplates, with eight pattern duplications on it, was made in six hours, excluding stoving, the work being done by one man. A large plate, with only one pattern, was completed in 2½ hrs. Those times indicated how cheap the method could be if it were exploited.

MR. PERRY visualized that, if a foundry could make several plates per day, the cost would be about £8 per plate. At the moment the cost was probably up to double that per plate.

Contraction Allowance and Casting Temperature

MR. ALAN H. MUSSON (Miralite, Limited) asked what allowances were made for contraction on the master pattern, and what was the temperature of the aluminium when poured.

MR. POTTS replied that, for sizes up to those which he had produced so far, he had found that one could exclude the contraction problem on casting. There was very little or no contraction on the plaster itself. Pouring temperature should be as low as possible; at his works jobs were pouring at between 600 and 620 deg. C., which appeared to exclude the air trouble to which Mr. Perry had referred. He, also, advised that the asbestos washer should be kept as thin as possible and it was advisable so to judge the amount of metal required that there was always a fair amount left in the cylinder at the end of the pouring; that was another method of excluding air.

He had been using L33 alloy, but believed that D.T.D.424 could be used quite successfully. It was hoped later to try a heat-treatable alloy in order to secure greater rigidity so that a single-sided plate could be used.

MR. M. BOYD (B. & D. Products (Halifax), Limited), expressed the view that a fabricated multi-pattern plate would give better service than a cast plate. In the latter case, if one of the patterns became bruised or otherwise damaged, the plate had

* Paper presented at the Brassfounders' Productivity Conference, Harrogate, and printed in the JOURNAL, July 31, 1952. Mr. G. F. Mundell presided.

to scrapped, whereas if a pattern on a built-up plate became damaged it could be replaced. Surely, he said, if a pattern were mounted on a flat-faced plate, a split pattern was required, but if the Authors could say how to make a good plate with solid patterns cheaply, he would be glad to hear about it.

MR. POTTS, after reminding the meeting that the process was in the experimental stages, said that a split pattern was not required. One could take a solid pattern and bed it in plaster to a proper joint line, so that one had part of the pattern on both sides of the plate. So far as the damaging and replacement of patterns was concerned, if one had to replace the pattern by duplication it must cost somthing. The system described in the Paper was very cheap, and he imagined it wouud be almost as cheap, in the case of a plate with four or six impressions on it, as to turn out a wooden master-pattern again.

MR. BOYD said that a master-pattern was needed whatever system was used. He emphasized that one could always replace a unit on a fabricated type of plate.

Pattern Duplication

MR. MANTLE commented that the description of the process in the Productivity Team's Report dealt almost exclusively with the production of aluminium matchplates from master-patterns which were not split. The process was very simple. One started with a wooden master-pattern of the object to be produced from the pattern plate; then one took a block of plaster and gouged it out so that one could embed half the pattern in the plaster. Then a modelling clay was used to build up around the pattern to form a joint line, and this arrangement was used as an odd-side. One could cast as many duplicates of patterns as one liked from that one odd-side. If further pattern-plates were required, it was a simple matter to build up the plaster mould again from the odd-side or a master plaster-cast made from it.

Only one master-pattern was needed. The process became more and more attractive, therefore, the greater the number of pattern duplications there were on a plate; and he emphasized that aspect.

MR. PERRY pointed out that another suitable application of the process was the making of individual patterns, not for a plate, but for mounting. From one master-pattern, very accurate reproductions could be made, and a lot of cleaning-up time could be saved.

MR. W. R. MARSLAND (president of the Association of Bronze and Brass Founders), commenting that there seemed to be an impression here that Americans were using only small plates, said that in the United States he had seen matchplates 72 by 18 in. being used. When he had asked how many castings were made off those plates he was told that the firm concerned received an order for 12 at a time, four times a year, and they were justified in making a matchplate of that size for production of that order.

MR. G. SWINYARD (J. Stone & Company (Charlton), Limited) said it had to be borne in mind that much of our aluminium came from the United States. The technique described seemed advantageous, but he invited comment on the manufacture of those sorts of plates as opposed to the method of manufacture in which a hard plaster was used. His concern was that, if the whole industry turned over to the use of aluminium for matchplates, it might affect the aluminium supply situation of the country.

MR. MANTLE said he did not think that the quantities of aluminium that would be used in this country, even if every foundry turned over to the use of aluminium matchplates, would make a great difference to the supply position. Secondary material was constantly coming into the market.

Members of the team had seen stone matchplates, which were used in some foundries in the United States. They appeared to be rather more fragile than the metal plates, were liable to crack unless treated carefully, and were less suitable than metal ones for long runs of castings. He believed there were many advantages in the use of a metal plate, such as improved draw and wear resistance.

MR. COOKE (Eagle Brass Foundry Company, Limited) asked if it were the practice to varnish or otherwise coat the aluminium plates.

MR. POTTS replied that they were given no treatment at all. Recalling the earlier reference to the duplications and the master pattern required, he said that only one wooden master pattern was required, and reproductions were made from it time and time again, and all the core-prints would be of exactly the same size.

MR. P. W. COLLINS (Whyte & Collins, Limited), discussing the treatment of patterns, said his firm had made aluminium patterns for many years and had noted that a certain amount of oxidization took place when patterns became damp. Patterns coated with a cellulose paint better withstood the wear due to the sand and obviated the oxidization trouble, and the paint could be renewed when necessary.

Differential Contraction

MR. T. H. WEAVER (W. & T. Avery, Limited) felt that there must be some differential expansion and contraction between the core-boxes, the plaster and the patterns, and wondered whether the Authors had experienced any contraction trouble with intricate jobs which necessitated casting thicknesses down to $\frac{1}{16}$- or $\frac{1}{8}$-in. sections.

MR. POTTS said the examples exhibited represented more or less the type of products tried out so far. He had been experimenting only for nine months, and obviously dealt with the simpler jobs first. There did not appear to be any expansion and contraction trouble which would upset the founder when using plaster, and he was of the opinion that, by the method described, one could cast sections in thickness down to $\frac{1}{32}$ in. quite easily. He believed that thickness of section would not be a limiting factor; judging from the intricate jobs which the mem-

bers of the Productivity Team had seen made by that method in the United States.

MR. FRANK HUDSON added that he had seen one or two firms in the United States making bronze and gunmetal castings in plaster moulds. Concerning Mr. Weaver's question regarding expansion and contraction he pointed out that one could produce a gunmetal casting from a plaster mould as accurately as a die castings, with tolerances of 0.005-in., so that expansion and contraction was very small indeed.

MR. WEAVER asked if there was different treatment in the drying stove to account for varying thicknesses of plaster.

MR. W. R. MARSLAND said that perhaps Mr. Weaver had had an experience similar to his own. He had made a plaster odd-side for working with a loose pattern. When he tried to get the loose pattern back into the odd-side, he found he had to work on the plaster before he could get it in. Therefore, it appeared that the plaster was contracting.

Compensating Ingredients

MR. P. W. COLLINS said that dentists, when making dental plates, controlled the expansion of their plaster moulds by using chemicals. He believed one of the chemicals was potash; thereby it was ensured that the plaster would expand to exactly the extent to which the dental plate contracted, so that they were able to produce a plate which would fit perfectly in the mouth. Possibly that sort of method could be applied in the production of castings in which accuracy was very important.

MR. L. BUCKLEY (Newman, Hender & Company, Limited) asked in what types of foundries in the United States the matchplates of the type described were used mostly. His reason for asking the question was that he appreciated that the patterns described were really first-class in many applications, but it might be contended that the use of snap-flasks in the United States had forced the use of the double-sided pattern-plate solely because of the weight. Surely, the same application could be made on a pair of machines, each machine using a pattern-plate with the pattern on one side.

MR. MANTLE replied that the team had seen matchplates used in every foundry they had visited; in the jobbing foundries there was always a machine-moulding section where they were used, and they were used to the exclusion of all other types of pattern equipment, he believed, in valve foundries making very much the type of product with which Mr. Buckley was dealing. He did not know that the use of the snap-flask had any great signficance in that connection. The team had seen matchplates used with both snap-flasks and moulding-boxes, and, curiously enough, the output of moulds per hour did not vary very much between the two cases. With matchplates, the layout could be very much simpler than two machines in tandem. Among the other advantages arising from the use of matchplates was that very accurate registration of the top and bottom parts of the mould could be achieved; they were both made at the same time off the same pin-centres, and using the same plate. When one used two different plates, making top and bottom separately on two different machines, it was not certain that one would always achieve such good registration.

As to the shrinkage, that obviously depended on the use of the correct plaster. He was not a plaster chemist, but he believed that by choosing the right type of gypsum, by regulating correctly the amount of water used, and so on, expansion and contraction could be controlled over quite a range; obviously one needed to aim at achieving negligible contraction during stoving, and he believed that was quite practicable, judging by the results obtained by Mr. Potts.

Special Plasters

MR. C. L. HADDON (Gotham Company Limited) said the plaster chemist had great control over the volume changes in plaster in various stages. A speaker had mentioned the use of plaster moulds for casting gold. For that process, the so-called lost-wax process, the plaster was mixed with cristobalite which gave a mix which expanded on heating to the same degree that the gold contracted on solidifying and cooling. A metal-casting plaster was somewhat different; it was one that expanded slightly on setting but contracted the same amount on calcination when the combined water was driven off. A note of warning should be added that there were two forms of anhydrous calcium sulphate (similar to red and yellow phosphorus) and one changed slowly into the other around 450 to 500 deg. F. with a contraction of about 1 per cent. in length. If this contraction was met with, it was a sign of overheating, and safe heating was achieved if the moulds were still steaming as they were removed from the oven as they were in Mr. Potts' experiments.

MR. POTTS said that in the process described in the paper the stoving temperature was controlled at round about 400 to 420 deg. F.

He had found it was of advantage to have the moulds fairly warm when tapping the aluminium into them; it appeared to give an improved finish but he was not sure whether it would help with regard to contraction.

MR. FRED F. MESSHAM (A. Messham & Son, Limited) said his firm worked for a company which had a parent company in America, and some time ago they had sent him an American-made matchplate, asking his firm to work with it. When his men saw it they were delighted. It was put into production at once. There were 24 mould bushes, in Admiralty gunmetal, on one plate, but 75 per cent. of them turned out to be scrap, the fault being that the runners were not large enough and the castings were too far away from the ingate. Thus it seemed that, when one ordered a matchplate from a patternmaker, one must ensure that such dimensions were correct, otherwise money was wasted.

MR. FRANK HUDSON said that in America the Team had found that quite the largest percentage of gunmetal castings made there were of the 85/5/5/5 material, and he suggested that the plate mentioned by Mr. Messham would be used with that metal, whereas in this country 88/10/2 was

Aluminium Matchplate Patterns by the Pressure-cast Plaster Process

used. The 85/5/5/5 gunmetal was easier to handle and would give good castings.

MR. MESSHAM, however, reaffirmed the plate had been sent for use with 88/10/2 gunmetal.

MR. MANTLE did not think that either the matchplate or the manufacturers were to blame. The manufacturers had the job highly organized, and when one ordered a matchplate, a chart giving an outline of the plate was posted back from the makers on which the dimensions were entered and the places where the patterns were to be distributed, as well as the size of ingates, etc., had to be indicated. The matchplate maker made the plate to his customer's requirements and could not be blamed if the plate was incorrectly designed.

MR. P. D. WILD (A. G. Wild & Company, Limited) asked if matchplates could be used where there was a deep vertical face on the pattern? The degree of steadiness required for withdrawing the top-part box might be too much for doing it manually and there was therefore the danger of damaging the mould which did not exist with a machine draw or with the light plate being withdrawn off the bottom-part box. How was this problem overcome?

MR. MANTLE replied that although it was felt that there was a very large field of usefulness for matchplates, this was not to imply that they were the answer to every moulding problem. Where there was a deep vertical face on the pattern, he agreed it would be difficult to withdraw the top-part box manually. Sometimes, however, the job could be so arranged that the vertical face could be on the underside of the plate which was easily drawn off the lower box.

Nomenclature

MR. C. POTTER (Fairbairn Lawson Combe Barbour) said some misunderstanding existed as to meaning or interpretation of "matchplates." He had always regarded them as being single-sided and suitable for use on flat moulding-machine tables to produce cope and drag in one operation. He thought there was some definition in the British Cast Iron Research Association's dictionary of foundry terms. Be as it may, he felt the mechanized British foundry trade in the case of the small box favoured single-side plates with patterns mounted side by side and producing the mould in one cycle.

The specimen patterns he had seen produced by the plaster process gave a very excellent reproduction, and he could not see why the technique should not be applied to single-sided plates. He agreed that the matching of joint-lines was easier in the case of the double-side type. He was producing in the foundry to which he was attached quite a number of aluminium single-sided plates by the usual sand method as follows. A pair of cast-iron frames ¾ in. thick were prepared; these were machined on both sides and then clamped together. The insides of the frames were then machined to the size of the pattern-plate required and jig-drilled to pin sizes and centres before separating. These were located next over the two halves of the mould with selected pins, covered with flat top and cast in the normal manner. Matching was then easy, the edges of the pattern plate being a perfect guide. It was only necessary to clamp the plates back-to-back with the edges square and drill the pin-holes in a drilling jig.

MR. MANTLE said the matchplates referred to in the Paper were plates having a matched pattern on each side so that one side of the plate made the cope of the mould and the other side the drag, this being done on a single moulding machine in one cycle of operations. However, the technique for making these aluminium patterns could also be used for making single-sided plates.

MR. C. A. TIMMS (Billington & Newton, Limited), concerning the economic use of matchplates, said his firm now had a department using the matchplate technique of moulding from fabricated plates and found the process very successful, using completely unskilled labour. By suitable coring to avoid step joints, these fabricated plates could be made fairly economically under standard patternshop conditions.

The pressure-cast aluminium matchplate, however, was a very distinct improvement, in that typical British odd-side and bench-moulding work now being carried out by skilled labour or apprentices could be made into a semi-skilled process. For the small quantities usual in this class of work in British foundry practice, it was essential that the pressure-cast matchplate should eventually be made at a low price. For this reason, he suggested that, as in America, the manufacture of the plates should be done by specialist firms as distinct from foundries attempting to make their own. If this could be achieved, he was certain that plates could be supplied to foundries at a price between £8 and £15 each, and British jobbing foundries would benefit by the increased production resulting in the use of unskilled labour at a very small monetary outlay for the pattern equipment.

THE AUTHORS agreed wholeheartedly with Mr. Timms' comments.

Staveley Iron & Chemical Shares Hearing

On the ninth day of the hearing—July 24—to determine for compensation purposes the value of the shares of the Staveley Iron & Chemical Company, Limited, the Iron and Steel Tribunal, meeting in London, announced that its award would be reserved. The Ministry of Supply had offered £5,100,000 compensation for the company, which was nationalized in February, 1951, and the company is claiming £8.750,000.

AS A RESULT of another record year the directors of the group of companies under the parentage of Qualcast, Limited, Derby, have decided to repeat last year's extra holiday bonus to employees over the statutory payments. The bonus will be an average week's gross pay, subject to PAYE, and will be given to all who have completed 12 months' continuous service with the company as at June 30, 1952.

Structure of Nodular Graphite

Although during recent years much has been published on the production and heat-treatment of nodular cast irons, less information is available on the structure of the nodules and the reason for their formation. The subject is discussed by H. M. WELD, R. L. CUNNINGHAM, and F. W. C. BOSWELL in the (American) *Journal of Metals*. The Authors state that an explanation of the phenomenon of nodulation must await a detailed knowledge of the nature of the nodule itself. Meanwhile disagreement exists as to whether or not a nodule actually contains a microscopically visible, non-graphitic nucleus, and the Authors' present work was initiated with a view to obtaining definite information on this and other aspects of the problem. It appeared that a chemical comparison of separated nodules and flake graphite would be profitable, for if the core is non-graphitic a relatively large amount of certain elements would be found in the nodules as compared to the flake. This comparison could best be made by obtaining nodules and flake from the same melt of cast iron, part of which had been inoculated with a suitable addition reagent for the formation of nodules.

To this end a 300-lb. melt was produced, about half of this being inoculated in the ladle with an Fe/Si/Mg alloy to produce nodules, and cast into keel blocks; the remaining half of the melt had silicon added in an effort to compensate for the silicon in the inoculant used in the other half of the melt and this was cast into similar keel blocks. The percentage analyses of the resultant irons were as follow, nodular iron being given first, with grey cast iron in parentheses:—C, 3.16 (3.36); Si, 2.29 (3.24); Mn, 0.45 (0.43); S, 0.001 (0.045); P, 0.023 (0.024); Mg, 0.051 (<0.00025—estimated spectrographically); the remaining elements also determined spectrographically were: Ti, 0.011 (0.008); Al, 0.055 (0.048); Cr, 0.025 (0.020); V, <0.004 (<0.004); Ni, 0.030 (0.042); Cu, 0.09 (0.10); Mo, 0.010 (0.007); Sn, 0.013 (0.013).

The main conclusions reached by the Authors are as follow: Metallic iron is randomly entrapped during the growth of nodules; flake and probably nodules contain a non-ferromagnetic iron compound. Apart from the entrapped iron, there appears to be no element in sufficient quantity to account for a visible nucleus. This metallic iron, however, is not associated with the central position. Manganese and copper, it was found, are relatively concentrated in flake graphite. The Authors consider it is still possible that a submicroscopic non-graphitic crystallization nucleus exists in the nodule, and chemical evidence suggests a nickel compound. Partition of the magnesium addition between the metal and the graphite is shown to be independent of whether the graphite is in the form of nodules or flakes.

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are about to install X-ray or gamma-ray equipment for inspection purposes, this handbook will be of immense value. Most of the contents of the book are taken from previous publications and compiled in such a manner as to become most useful to the radiographer.

R. J. H.

Book Review

Practical Radiography for Industry, by H. R. Clauser. Published by the Reinhold Publishing Corporation in the U.S.A., and in this country by Chapman & Hall, 37, Essex Street, London, W.C.2. Price 60s. net.

Radiography has become an accepted medium of industrial inspection, and a publication such as "Practical Radiography for Industry" is long overdue. In the introduction the Author gives a brief history in non-technical terms of the discovery of X-rays and radioactive substances. This history is not only interesting but also necessary for the untrained radiographer to understand the fundamental principles underlying the practical application of X-ray or gamma radiography. It is doubtful if the characteristics, properties and generation of X-rays contained in chapters 2 and 3 will be fully understood except by the trained physicist, and perhaps this information could have been compiled in less technical language, but the illustrations are of simpler character and offset the somewhat bewildering mathematical formulæ.

Chapter 5, dealing with exposure factors and technique, is well written, and should be closely studied by the intending radiographer. Sensitivity and radiograph quality contained in chapter 6 is also most instructive, and Fig. 6-4 illustrates clearly the types of scatter radiation which can reduce considerably the value of a radiograph. Films and film processing have been dealt with in a most detailed manner worthy of close study by the beginner, as good dark-room technique is essential for obtaining satisfactory radiographic results. Although the producers of films listed are all American, radiographic films of other manufacturers are available in this country, and in the opinion of the reviewer give superior results to those quoted.

It would appear from chapter 8 (gamma-ray radiography) that radio isotopes are not used by the American industrialist to the same extent as his counterpart in this country, and radium is apparently the most-used source of gamma rays. This is somewhat surprising, as sources of CO.60 or IR.192 give superior results to those of radium and are to be recommended for gamma radiography, particularly for steel castings. Basically the principles of gamma radiography remain the same, whether radium or radio-isotopes are the emitting source of radiation, and the chapter deals adequately with these principles. Although lead is given as the protective medium in source containers, tungsten is preferable and affords greater protection to the operator.

The last chapter outlining the health hazards to workers when exposed to X- or gamma-radiation should be carefully applied by the radiographer, and the extra precaution of periodic blood counts of workers should be added to the list of measures of protection. Although training is necessary, knowledge of advanced physics is not required of the industrial radiographer. On the other hand, the effectiveness of the process, the radiographer's ability to accomplish his task with a minimum of exposures and in a minimum of time, his ability in judging the seriousness of a defect in the object at hand, is a function of his experience and aptitude. Given an opportunity to observe and to follow the process involved in the correction of a defect discovered by radiography, the radiographer soon develops good judgment in the appreciation of the seriousness of a defect, and acquires background which will be helpful to him in the future tasks he is called upon to perform.

For industrialists who have recently installed or who

(*Concluded at the foot of col.* 1)

Fettling-shop Small Tools

The smaller items of equipment in the fettling-shop can be very important factors in the economic conduct of a foundry. Our representative recently had the opportunity to investigate the performance of a Hicycle plant installed in the works of the East Sussex Engineering Company, Limited, at Lewes, by the Consolidated Pneumatic Tool Company, Limited, of 232, Dawes Road, London, S.W.6. The plant serves about 20 portable grinders and a couple of drills, and for their operation are installed a pair of 10 k.w. frequency changers. The latter increase the frequency to 200 cycles and reduce the supply voltage of 440 v. to 125 v. A very low voltage of 72 to earth is obtained by earthing the neutral point of the frequency-changer windings. This feature of high-frequency tools makes them safe to use. The application of the high frequency to the three-phase motors of the grinders give a high power/weight ratio resulting in a constant speed, free from any drop under load, and thus meets the most essential condition for economic grinding.

FIG. 1.—*Cleaning-out a Slot on an Iron Casting using a Portable Electric Tool*

These portable grinders, weighing under 21 lb., were in constant use carrying 6 by 1 in. bonded wheels having a cutting speed of 9,500 ft. per min. running at a little under 6,000 r.p.m. The wheels, when worn down to a diameter of 4 in. are transferred to a smaller grinder running at a higher speed so as to restore the original cutting speed.

There were also available—and in much demand by the fettlers for notching runners and risers—some Uni-lastic wheels $\frac{1}{8}$ in. thick. These wheels are reinforced with fabric and are practically unbreakable. They are not the type described in the Brassfoundry Productivity Report, but are potential money-savers.

This Report opened with a reference to small tools in the economic conduct of a foundry, and from our investigations at the East Sussex Engineering Company, it was demonstrated on regular production work that the constant speed of high-frequency tools results in faster grinding, or an increase in output. It was also evident that this constant speed adds life to the grinding wheels, by removing more metal per unit wear of wheel, and fewer h.p. or k.w. are required for their operation. A grinding plant of the type we visited requires only 25 per cent. of the power of an equivalent compressed-air plant, and, at the same time, capital cost is lower. Some interesting figures were available showing these economies which are typical of many hundreds of tools working in the iron and steel industries. The maintenance department were well satisfied with the service given by the plant they have installed.

Publications Received

Classification of Copper and Copper Alloys. Published by the Copper Development Association, Kendals Hall, Radlett, Herts.

This useful pamphlet, which consists of data in tabular form, has been thoroughly revised since it was first published in 1948. A quite high percentage of the tables is devoted to the composition and mechanical properties of castings. Every brass and bronze founder should make this publication available to his staff. It will be sent gratis to our readers on writing to Radlett.

Steel Construction. Published by the Anglo-American Council on Productivity, 21, Tothill Street, London, S.W.1. Price 3s., post free.

How very different are these productivity reports. One recently dealt with by the reviewer was a mass of statistics, whilst this one is essentially practical. It is also of outstanding interest as it deals with an industry which in this country is riddled with what is known as "demarcations"—that is, the reservation of the many tasks involved to the various classes of skilled artisans. In America, one skilled man has half-a-dozen trades at his finger-ends, and so no time is lost in "waiting for his mate." That similar conditions must be introduced here is an obvious deduction, yet it is omitted from the final conclusions. Indeed, it should have been a recommendation. The reviewer, when working on the North-East coast, was thoroughly humbugged by demarcations which only a specialist in trade-union affairs could master, in all their ridiculous complications. A carpenter was not allowed to mend a window, electricians could deal with floorboards up to certain sizes, and so forth. There was much suppression of this nonsense during the war, yet apparently it still exists. Since the introduction of the five-day week, it is remarkable how many people find they can decorate their own houses and exercise other skills in which they served no apprenticeship. Though a number of practical tips are given in the report, there is printed too much of what has already been dealt with *ad nauseam* in earlier reports, such as the inclusion of particulars of the American trade union set-up. Presumably a picture of a Sandslinger has been included to "break up the type," for it is difficult to find any other reason. The conclusions printed are somewhat "wishy-washy."

ALTHOUGH the precise increase has not yet been settled, the steel allocation for merchant ship-building will be increased from October next. Announcing this in the House of Commons last week, the First Lord of the Admiralty stated that the increase would not be less than 5 per cent.

Process Control of Cast Iron for Vitreous Enamelling*

Discussion of Mr. J. Bernstein's Paper

It was apparent at this meeting that a number of enamellers were imbued with a grouse against the suppliers of castings, alleging widespread deterioration of quality. This viewpoint was not very well substantiated factually in the discussion recorded. The statements of the Author as to the need for quality control at all stages—in the enamel-shop no less than the foundry—were upheld. Nevertheless, it was felt that further discussions would be profitable, possibly at section meetings, so as to better reconcile founders and enamellers joint appreciation of problems and the means to overcome them.

Introducing the Paper, "Process Control of Cast Iron for Vitreous Enamelling," by Mr. J. Bernstein, A.R.I.C., A.C.T.(Birm), A.I.M., the chairman, DR. J. E. HURST, said Mr. Bernstein was in no need of any introduction, because he was well known to enamellers and foundrymen. His subject was of even greater importance than sheet steel to the vitreous enamelling industry. So much so that the Institute had a sub-committee, of which Mr. Bernstein was a member, which was dealing with the matter.

MR. WHITAKER, opening the discussion which followed presentation of the Paper, and speaking as an "enameller to the trade," or "jobbing enameller," who had to be prepared to enamel any castings sent to him, after 20 years' experience said quite definitely that never had his firm had more trouble with defective castings than at the present time. Mr. Bernstein had said that technical control in vitreous enamelling had about kept pace with that of ironfounding, but unless the improvements in enamelling technique had exceeded those of casting production, the ironfounders to-day would be in a difficult position.

Porosity the Major Fault

The chief fault was porosity, not just a mild "sponginess," but in many cases large blowholes and cavities, and such castings were being produced not only by small concerns, but by firms of national repute, employing trained technicians. After many years' satisfactory production of "direct-on" enamelling of cast iron, his firm was for the first time having to resort to the use of a matt groundcoat. Also, while formerly many castings could be enamelled without annealing, this was now necessary in practically all cases. It was fully recognized that the ironfounder faced many difficulties in the matter of pig-iron and scrap, but it was unfair to blame the enameller for what were obviously foundry faults.

As regards other points, he considered it to be a mistake to leave castings in the sand overnight, as there was then difficulty in getting rid of the absorbed moisture. He agreed entirely with Mr. Bernstein that the quicker castings were put through the various stages in the enamelling process, the better. Annealing and shot-blasting (especially by the airless method) were rather drastic operations, and a certain amount of distortion was bound to occur. They were, however, essential operations and castings should be so designed and made of such metal as to stand up to the process with a minimum of distortion.

Better Castings Essential

MR. BARKHOUSE complimented Mr. Bernstein on his very able defence of the foundryman. He believed that an article finished with vitreous enamel on cast iron as against sheet iron was far more lasting an article and a better job. On the other hand, as an enameller and one who had nothing to gain, he could say it was much easier to enamel sheet-iron parts than cast-iron parts. The number of sheet-metal parts rejected after enamelling for metal faults in the plant at which he worked was less than 1/10th of one per cent. While the total percentage of enamelling rejects was greater, they were mostly process rejects, and parts that had been chipped in assembly. But as far as cast-iron enamelling was concerned, it was not, to his mind, an economic proposition. While Mr. Bernstein could not agree that cast iron produced nowadays was worse than it was 20 years ago, he was careful to cover up his tracks by saying that, in view of the supply difficulties with pig-iron and the inferior scrap, it might be. As far as cast-iron enamelling was concerned, either the foundryman must give enamellers a consistent casting or the vitreous enamelling frit manufacturer must give them something which would cover those castings much better than at the present time.

MR. MCNAIR said that after some 25 years' experience in the ironfounding and enamelling industry he was rather disturbed to find that Mr. Whitaker had pointed to the lack of progress in regard to control in foundries as compared with the progress made in other departments of the vitreous-enamelling industry. He felt, however, that there was still a great deal of scope in the foundry. Too much attention was paid to mechanization of output without due regard to consistency of quality. Doubtless it was true to say that founders were in difficulties with the raw-material position. He made no excuses for that, however, because he agreed with Mr. Bernstein that that could be overcome.

He had been rather struck by Mr. Bernstein's

* Paper presented to the Spring Conference of the Institute of Vitreous Enamellers, and printed in the JOURNAL, June 5 and July 10, 1952.

remarks as to the difference in castings from slow and fast melting. Could Mr. Bernstein carry those further, especially with reference to slag? Consideration also could be given to available supplies of pig-iron in relation to the limestone condition and to the relative proportion of oxides and sulphides in the slag and those in the metal. He hoped this could be linked with the temperature and speed of the melt.

MR. LAITHWAITE said he was in the position of being responsible for the development of enamels and with trying them and was in a works which made its own castings and therefore got various points of view. Mr. Bernstein's theme was a good one. He, himself, thought the key to the matter was control; control in the foundry was a necessity just as much as it was in the enamel shop. He did not agree with other speakers that castings were worse than they were. Many changes had taken place. Foundries were now mechanized and the old moulding methods had to go, and founders were still, in certain fields, having to find the best way of making castings by mechanical methods.

Compare Like with Like

His other point was that, if he had the opportunity of taking to-day's castings and applying the finishes of 20 years ago, he would get good results. If members were making comparisons, let them compare relevant factors. They should not compare the difficulties of to-day with the difficulties of 1928. To-day, enamellers were working to very high standards; perhaps they were aiming at something from castings which they could not be expected to be able to give consistently, since one small defect on a casting to be finished in white enamel caused rejection.

In his own organization, some castings were enamelled in a variety of finishes. One of the finishes was a splatter mottle and the other a plain cream, and in that particular case the same frit was used throughout. In the plain colour they rejected more than 50 per cent., but 95 per cent. were passed in the splatter finish. That was the measure of the difference between various types of finish, and it was fundamental in considering the main problem that this fact should never be overlooked.

Iron Composition Changed for Better

DR. HARTLEY said his own experience covered a somewhat longer period than Mr. Laithwaite's, and he had played a part in the introduction in this country of what were called stain-resisting enamels for use with cast iron. Before acceptable results could be obtained, it was found necessary to change the composition of the castings. Prior to that date, a typical casting had contained relatively large graphite plates and was easily "burnt" during the enamelling process.

The higher fusing temperatures required for the working of the new enamels compelled the making of the change in the composition of the castings produced, and to say that the castings of to-day were not as good as they had been 20 years ago was not correct—they were very much better!

Some of the defects in enamelling arose from the presence of dust. The key to the solution of the problem was given by Mr. Bernstein in his opening remark, when he said that he did not want dust in his laboratory. "Dirt" was really "matter in the wrong place," and it would help the enameller if he would always bear that in mind. It was not possible to get satisfactory results from day-to-day without adequate control in the foundry and in the enamelling department. It was so noticeable that, when trial runs were being made, the results often were much better than those which followed under ordinary production conditions. In the test-run, the control of the operation was generally much better. For success there must be close co-operation between the foundry and the enamelling department, and this should be obtainable if both departments were directly responsible to the same executive.

MR. RYDER remarked that hearing the present Paper in conjunction with a previous one on steel enamelling had made him realize what peculiar people enamellers were. In the earlier discussion they had said they must have steel with next to no carbon and a minimum of phosphorus and sulphur, and if they wanted to apply a white enamel to that "refined" iron, they had to go still further and put a nickel flash on it. Then, in the present instance, they turned round and expected to take an alloy containing something over three per cent. carbon, as well as phosphorus and manganese and so on, and to apply a white or pastel enamel on to that direct after shot-blasting. It sounded rather a contradiction when regarded impartially. As regarded bad castings, he supported Mr. Bernstein's plea for cleanliness, and felt that many castings returned were examples of bad housekeeping and could be corrected or overcome by the methods the Author had suggested.

Recent Deterioration?

MR. WHITAKER said he was not comparing the castings of 20 years ago with those of to-day. There had been a degeneration in quality during the past 12 months, and especially during the last three months.

MR. THOMAS said Mr. Bernstein had mentioned the rate of melt for cupolas. Was it possible to modify this, or had one to operate at the normal melting rate regardless of the need of the moment? When it was necessary to operate at 50 per cent. of the normal rate, was there anything which could be done so that those castings, instead of being scrap, as it appeared, could be processed like castings the metal for which was produced at the normal melting rate?

Due to shortage of time, the chairman had to close the discussion at this point, and MR. TODD suggested that, in view of the importance of the subject, Mr. Bernstein should be asked to attend each section throughout the coming winter, so that the sections could give an entire evening to discussion. The cast-iron sub-committee of the Institute would welcome any criticism.

Replying to the discussion, MR. BERNSTEIN said he was in agreement with Mr. Todd's suggestion that the subject could with advantage be discussed at greater length at section meetings as there was insufficient time them to deal individually with the comments made. Owing to shortage of time he had initially been forced to limit the introduction to the Paper and he would be glad to have a further opportunity of stressing certain points only briefly mentioned.

He was concerned to hear from Mr. Whitaker of the deterioration which he assured the meeting had actually taken place, and had further proceeded in the last few months. Mr. Bernstein asked if the output from Mr. Whittaker's department had increased in recent years and suggested that if this were so, might not his impressions of the quality of the castings supplied to him, be confused with his difficulties in maintaining an ever-increasing throughput? The organization and control required for the enamelling of a large number of castings compared with the need for mechanization for greatly increased outputs of castings, but it was wrong to blame enamelling rejects on to mechanization in the foundry. He questioned Mr. Whitaker's comment on the progress of technical control in vitreous enamelling and reiterated in this context a phrase from the Paper "... much that is known remains to be applied."

Mr. Whitaker was not alone when he blamed the castings on finding that he had to anneal certain castings or even apply a matt ground-coat. It seemed to Mr. Bernstein quite general that the first and then successive increases in rejects were attributed to a deterioration in the castings. He felt, however, that it was an admission of weakness on the part of enamellers when they took that point of view without being in a position to substantiate their claim with facts. He was glad that Mr. Whitaker agreed with him on a number of points and would be able to visit his works on some occasion.

Raw Materials Difficulties Avoidable

The Author disagreed with Mr. Barkhouse when he said that the enamelling of cast iron was not an economic propsition; he felt that it could be made to be so even when it might not be apparent in certain works. He said he may have expressed himself badly if he gave Mr. Barkhouse the impression that castings of to-day might be worse than those of yesteryear due to the difficulties in the supply of pig-iron and scrap to foundries. With metallurgical control and supervision at the charging stations, troubles could be avoided to a great extent.

Mr. Ryder had touched on a vital spot when he called enamellers peculiar people who wished to enamel cast iron and steel and yet complained about both. Why, then, did they not try to enamel some other material ? As time had expired for continuing the discussion, he proposed to conclude his remarks, and if the Chairman approved, reply briefly to the other speakers in writing, bearing in mind that there might be a future meeting at which the whole subject could be discussed more fully. This suggestion was accepted.

Written Replies

MR. BERNSTEIN thanked Mr. McNair for his supporting comments on mechanization and metallurgical control at the cupola. He said that he was at present studying the influence of the slag during melting under different conditions and as yet he could not give any useful information, although he could say that he was having extraordinarily contradictory results ! At one time he would not use enamelled scrap in the cupola charges due to its effect on the slag, but he found that by using extra limestone when enamelled scrap was charged the fluidity of the slag remained satisfactory and no increase in non-metallic inclusions was detected in the castings on subsequent miro-examination.

Mr. Bernstein had in his office a number of castings known to be faulty but which had enamelled perfectly and he was indeed surprised to see what good results could be achieved with care on enamelling severely-pitted cast surfaces. The fact had to be faced that the standard of quality demanded to-day was higher than previously and enamellers had to exercise rigid control to achieve the results desired whether they were enamelling sheet iron or cast iron. He was prompted to say that the actual production of castings was fraught with more problems than the processing thereof and it was more necessary for the enameller to understand the difficulties of the foundryman than is was for the foundryman to sympathize with the enameller. The only certain way of ensuring continually satisfactory results in the vitreous enamelling of cast iron was for the foundry and enamelshop to work together. The foundry would find it difficult to work with any enamel shop that blamed every defect on to the castings.

Mr. Bernstein thanked Dr. Hartley for his remarks and mentioned that he had had identical experience in that experimentally or on small runs of castings good results were obtained but were not repeated on a large scale. The results of this experience had been used at a later date to obtain similar results in production by applying the control in the enamel shop which had been existing during the experimental stage.

Mr. Thomas's question on the method of achieving an optimum rate of melting could be answered in a number of ways dependent on the circumstances obtaining in a particular foundry. He could satisfactorily answer the speaker's point only on receipt of more information on the procedure adopted in the foundry. If the rate of melting had to be reduced by as much as 50 per cent. it would be beneficial in the first instance to reduce the diameter of the cupola by the introduction of a thicker lining. If casting was not continuous throughout the day, one or two alternatives were possible. It would be difficult to achieve satisfactory results in enamelling the castings if the charges to the cupola and rate of melting were reduced as much as indicated by the speaker.

Process Control of Cast Iron—Discussion

Written Contribution

MR. J. F. STEVENS wrote that his firm experienced a greater incidence of "boiling" with cast-iron components when the sulphur content exceeded 0.11 per cent., and by graphing the "boiling" rejects against the sulphur contents of the metal a relationship was apparent. Could the Author give any reason for this? He was also interested in the Author's opinion of whether the pouring temperature of the metal had any bearing on the enamelling qualities of cast iron.

MR. BERNSTEIN replied that he had himself plotted carbon, silicon, phosphorus, manganese and sulphur figures against the percentage rejects on scores of thousands of castings but a definite relationship between chemical composition and percentage rejects had not been determined. Trends in the form of the results did occasionally indicate points for investigation, but proof was not obtained that any one of the above mentioned elements, of the order of concentration normally found in light castings, could be nominated as the cause of so-called "boiling" rejects. The range of chemical compositions given in the Paper covered the range found to give good results, but, as also mentioned in the Paper, figures outside that range could in certain circumstances be tolerated. The figure of 0.12 per cent. sulphur was quoted in the Paper as being the top limit for sulphur in the list of recommended compositions, so that in a sense Mr. Stevens' experience confirmed that of the writer.

The temperature of the metal at the cupola spout was related to the melting conditions and appeared to affect the enamelling results, but the actual temperature of pouring the castings did not appear to have such a marked effect. It could, however, influence the results inasmuch as the pouring temperature might affect the quality of casting itself.

Applying a Monolithic Cupola Lining*

For preparing a monolithic lining to a cupola, the plastic refractory is applied up to about 9 ft. above the tuyere level, the quantity required being about 2.2 tons per cub. metre. An unskilled workman can ram at the rate of 4 cwt. per hr., finishing at a speed of 8 cwt. per hr. as he gets accustomed to the work and the manipulation of the template.

A template (Fig. 1) is constructed of steel ¼ to ⅜ in. thick, reinforced by angle-irons. It is about 20 in. deep, and the internal finished dimensions of the cupola govern its diameter. A hard-wood wedge serves to aid the vertical displacement of the template; this is 2½ in. wide at its base and 3½ in. at its top.

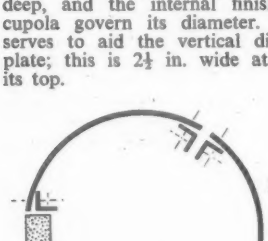


FIG. 1.—*Arrangement of the Formers and Cupola Wedge-piece for Ramming a Lining.*

To carry out the ramming satisfactorily, it is necessary to use a pneumatic or electric rammer, the head of which should form a ¼ by 2½-in. rectangle. The template is placed on the bottom of the cupola and a layer of the plastic refractory carrying 6 per cent. moisture is spread between the wall and the template to a depth of about 7 mm.† This must, like the layers which follow, be vigorously rammed. The various openings in the lining are made by ramming the material round suitable wooden formers or frames. Each time the top edge of the template is reached, the contraption is raised either by hand or pulley blocks. At each lift, the lower third remains surrounded by previously-rammed material or, in other words, the top edge is raised about 14 in. each time. From the commencement of the work, vent rods are placed vertically around the wall at 10-in. centres, so as to aid drying. These rods are 40 in. long, and should be inserted at the same time as the template. They are supported from hooks at their top ends. As the plastic refractory expands to an extent of 1 per cent. when lighting the furnace, the new lining should not be continued up to the iron or the refractory bricks constituting the upper lining of the cupola. Ramming is stopped when 4 in. below this brickwork, and the interspace is filled with a slurry made from the refractory. Radial expansion only is noticeable in the melting zone, and this on a reduced scale when the lining is properly prepared. If found necessary, the lining can easily be reinforced by introducing flanges bolted to the cupola shell.

Drying and Patching

After ramming, a briskly burning coke fire-basket is placed at the bottom of the cupola three or four times a day, according to the size of the furnace, the shaft at charging-hole level being closed by a steel sheet so as to conserve the heat.

For daily patching, the melting zone is carefully freed from adhering pieces of coke and slag, but it is essential not to disturb the vitrified crust of the lining. The slag-free wall is then coated with a fine liquid mortar prepared by first sieving a small quantity of dry refractory. The body of the plastic refractory should be prepared 12 hrs. before use. For its application, 4- to 6-in. dia. balls are prepared, and these are pressed to the wall by beating them with a suitable wooden tool. Probably the best results are obtained by following the method of pre-formed bricks. For this, either using steel sheet or cast iron, a brick mould is first made. It should be slightly tapering and about 10 in. wide, 24 in. long, and 5 in. deep. The plastic refractory is then rammed into the mould, using a pneumatic rammer. The brick is stripped and cut into four easily-handled portions ready for use in the section to be repaired. Finally, the patching is dried by the use of a small coke fire and draught should be reduced during drying by closing the cupola at charging-door level.

* Translated from *La Fonderie Belge*, the text being received from M. Zwartele, of Umafo, Herent-Louvain.

† We think this must be a misprint for 7 c.m., which would be a convenient depth to ram at a time.—EDITOR.

Charge-level Indicator for Cupolas

The introduction of mechanical charging of cupolas has accentuated the necessity for a charge-level indicator. Many mechanical chargers are operated entirely from ground level and it is, therefore, essential for some signal to be given to the operating station that the cupola is ready to receive another charge. Drop-bottom buckets are now greatly in favour, but if the operator attempts to put another charge into the cupola when there is not sufficient room below the bucket to receive the charge, the doors of the bucket are jammed and considerable inconvenience is experienced.

With hot-blast cupolas, also, it is essential that the charge level is maintained above a certain height when the cupola top-gas is sucked off below the charging door for supplying a recuperative system.* Unless the charge is kept up to this level there is a danger of air being drawn into the system, which results in the cupola top-gas being burnt before it arrives at the firebox. This pre-combustion gives a loss in efficiency and may damage the cupola top-gas mains.

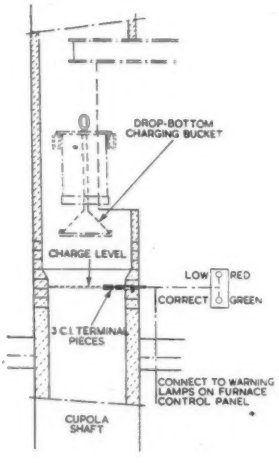


FIG. 1.—*General Arrangement of a Charge-level Indicator for an Ordinary Cupola.*

This need for a simple charge-level indicator has led to the development by Metallurgical Engineers, Limited, of the system shown in Figs. 1 and 2. (Patent applied for.) By this system, which has already been tried out in a well-known foundry and found successful, a red light comes on when the charge level drops below a predetermined point in the shaft. When it is above this level a green light is showing permanently. The circuit is extremely simple and if necessary a recorder can be placed in the circuit which can give to the foundry management a record of how the cupola has been charged throughout the day. It is suggested that one pair of red and green lights is placed at the charging operator's station and another pair, if necessary, can be placed in some control room or the foundry manager's office. The only contacts needed within the cupola are some robust iron bricks, as shown in Fig. 1, which illustrates a cold-blast cupola or as in Fig. 2 for a hot-blast cupola, incorporating the patented cupola top-gas take-off for which the same firm hold sole licence for Great Britain.

Also, for use in conjunction with both hot- and cold-blast cupolas, the firm have developed a water-cooled lining made from corrugated-face cast-steel jackets. In principle these are not of novel design, as the idea has been tried out and found successful by two operators and they now have an experience of some ten years behind them. The engineers have concentrated, however, on making the design one which is simple to erect and dismantle and which is suitable both for cold- and hot-blast cupolas.

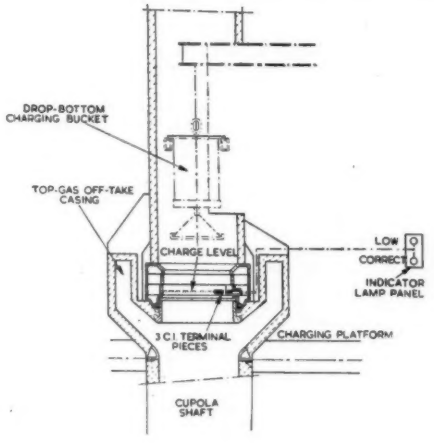


FIG. 2.—*Layout of the Charge-level Indicator applied to a Hot-blast Cupola.*

* British Patent Specification No. 662325.

APPLICATION is being made to Glasgow and Edinburgh stock exchanges for permission to deal in the 5 per cent. convertible unsecured loan stock and the issued ordinary shares of Henry Balfour & Company, Limited, of Durie Foundry, Leven, Fife. The main activities of the business, an old established one, now centre in the field of chemical and allied engineering, special installations being provided for a considerable range of industries. Order books are reported to be full for some time ahead. Issued share capital amounts to £90,600, of which £25,000 is in preference shares of £1 and £65,600 in ordinary shares of 5s. On the latter the dividend for the latest accounting year was 22½ per cent.

Personal

MR. AND MRS. FRANK CROFT have recently celebrated their golden wedding. Until his retirement in 1936, Mr. Croft was chairman and joint managing director of Crofts (Engineers), Limited, Bradford.

AMONG the recipients at the company's 22nd long-service presentation ceremony recently was MR. PERCY FORD, manager of the St. George's Mill of Guest Keen & Nettlefolds (Midlands), Limited, until his retirement last March.

MR. DONALD BASTOW takes up his appointment as chief engineer of Jowett Cars, Limited, Idle, Bradford, on September 1. He is leaving the B.S.A. group in Birmingham, where he has been research manager of the engine and mechanism laboratory since 1950.

MR. L. DE WYNTER has been appointed manager of the Ipswich branch of British Insulated Callender's Cables, Limited, with effect from August 1, in succession to Mr. A. R. Driessen who has been appointed commercial manager of the Indian Cable Company, Limited.

A FURTHER directorship has been assumed by MR. L. HALL DOWNS, who has joined the board of Blundell Spence & Company, Limited, the Hull paint manufacturers. He is a director of the Power-Gas Corporation, Limited, Stockton-on-Tees, and chairman and managing director of Rose, Downs & Thompson, Limited, engineers and ironfounders, etc., of Hull, which is a subsidiary of the Power-Gas Corporation.

FINANCE DIRECTOR of Imperial Chemical Industries, Limited, MR. STANLEY PAUL CHAMBERS, has been appointed a deputy-chairman of the company. There are two other deputy-chairmen, MR. A. J. QUIG and DR. A. FLECK. Mr. Chambers served as Commissioner of Inland Revenue from 1942 to 1947, and chief of the finance division of the Control Commission for Germany from 1945 until 1947.

A WELL-KNOWN personality of the coke-oven industry, MR. GEORGE HARRISON is going into retirement at the end of this year. For more than 50 years he has served the industry. When the Derwenthaugh coking plant was constructed by the Consett Iron Company, Limited, in the late 1920s, the position of manager there was entrusted to Mr. Harrison, who retained the appointment when the control passed to the National Coal Board.

MISS A. ANDERSON, coreshop chargehand in the "B.F." department of Glenfield & Kennedy, Limited, Kilmarnock, who is retiring, and MR. J. DOUGLAS, assistant foundry manager in the same department, who is taking up an appointment as general manager of the Argus Foundry Company, were honoured by the department staff last week. Miss Anderson, who has had 48 years' service with the firm, was presented with an occasional chair and a handbag; Mr. Douglas received a smoker's outfit and table lighter, together with an umbrella for his wife.

THE MINISTER OF LABOUR AND NATIONAL SERVICE has appointed MR. G. G. HONEYMAN to be chairman of the Civil Service Arbitration Tribunal in succession to Sir W. David Ross, who retired from the chairmanship last April. His appointment will be for a period of three years. Mr. Honeyman is an appointed member of the Industrial Disputes Tribunal and a member of the chairman's panel of the Industrial Court. He is chairman of several wages councils and has acted on numerous occasions as an arbitrator in industrial disputes.

Obituary

MR. WILLIAM HENRY JOHNSON, a director of J. R. Johnson & Sons, Limited, manufacturers of coal-cutter picks, of Sheffield, died recently. He was 71.

MR. JOHN THOMAS SMITH, formerly a foremen engineer at Stanton Ironworks, until his retirement five years ago has died, aged 67. He had been with the company for 50 years.

THE DEATH occurred recently of MR. LAMMOT DU PONT, chairman from 1940 to 1948 of E. I. du Pont de Nemours & Company, explosives manufacturers, of Wilmington, Delaware (U.S.A.). He was for several years chairman of General Motors Corporation, and all his life was an active member of the American Chemical Society. He was 71.

MR. J. BOULTBEE BROOKS, chairman of J. B. Brooks & Company, Limited, who died on July 29 at the age of 75, was a Birmingham man by birth, and early joined the business which his father had founded in 1866. He became a director in 1897 and chairman in 1921. A former High Sheriff of Worcestershire, Mr. Brooks was widely known as an industrialist and philanthropist. He was chairman of the Birmingham Assay Office, a life governor of Birmingham University and a life trustee of Lench's Trust.

MR. CHARLES RAMSAY RINTOUL, well-known Glasgow business man who had resided in Prestwick for 12 years, died suddenly, aged 67, in Dumfries Infirmary last week. A native of Glasgow, he took over the firm of James T. Donald & Company, Limited, steel and metal merchants, Glasgow, about 30 years ago, and was managing director at the time of his death. He was an active member of several incorporations in the city and a keen golfer.

MR. FRANK W. BENSON, who died recently, was formerly shipbuilding general manager with Scotts' Shipbuilding & Engineering Company, Limited, Greenock. A prominent naval architect, Mr. Benson served his apprenticeship with John Brown & Company, Limited, Clydebank. As a young man he went to Spain, remaining there for about 28 years, and was latterly shipyard manager with the Sociedad Espanola de Construccion Naval at Bilbao. In 1937 he returned to Scotland and joined the staff of Scotts' Shipbuilding & Engineering Company as naval architect, eventually becoming shipbuilding general manager, from which position he retired about two years ago.

Italian Metallurgical Association

The sixth national convention of the Italian Metallurgical Association is to take place in Genoa from September 20 to 23, when the Luigi Losana gold medal will be presented to Mr. John Chipman, president of the American Society for Metals, for his outstanding work in the fields of science and metallurgy. Mr. Chipman is to present a paper to the convention.

Sir Samuel Osborn's Will

Sir Samuel Osborn, president of Samuel Osborn & Company, Limited, steel manufacturers, etc., of Sheffield, who died on June 10, at the age of 87, left £239,989 1s. 5d. gross.

Sir Samuel was formerly Pro-Chancellor and Treasurer of Sheffield University, and was Lord Mayor of Sheffield from 1912 to 1913.

News in Brief

MEMBERSHIP of the American Foundrymen's Society has again reached 10,000.

DURING A SCRAP-DRIVE WEEK held recently at Newcastle-upon-Tyne, about 385 tons of scrap were collected.

SWEDEN is to send 120,000 tons of iron ore to Austria in the 12 months ending March 31 next under a trade agreement just signed in Stockholm.

SHELL-MEX & B.P., LIMITED, announce that a decrease in their inland trade price schedule of ½d. per gallon for B.P. Britoleum (fuel oil) became effective on July 30.

THE OFFICE APPLIANCE AND BUSINESS EQUIPMENT TRADES ASSOCIATION has decided to stage a second major business-efficiency exhibition to be held at Kelvin Hall, Glasgow, from November 4 to 14, 1952.

THE MINISTER OF LABOUR said it was difficult to make a firm estimate of the number of people at present engaged in producing goods for the export trade, but the total was probably something of the order of 2,000,000.

AN ORDER for a twin-screw motor cargo vessel has been placed with Swan, Hunter & Wigham Richardson, Limited, Wallsend (Northumberland), by the Rio-Cape Line. A similar vessel has been ordered from Vickers-Armstrongs, Limited, by Shaw Savill & Albion Company.

EMPLOYEES of Herbert Morris, Limited, lifting and transporting machinery manufacturers, of Loughborough (Leics), recently gave a display of arts and crafts in their works canteen. The exhibition was opened by Mrs. Howard Purnell, whose husband is a director of the company.

THE NEWS which Lord Swinton announced in the House of Lords last week concerning the freeing of the lead market was received with jubilation on the London Metal Exchange, and the move will doubtless be followed by demands for similar measures to be taken with regard to trading in copper and zinc.

FROM THE United States Information Service, American Library, 41, Grosvenor Square, London, W.1, has been received a list of new additions to the industrial section. Several are germane to foundry practice; they can be borrowed free of charge by any resident in this country.

PRIZES AMOUNTING TO £400 were presented recently to 74 employees who had sent in suggestions which might save the company many thousands in production costs, by Colonel M. A. Wolff, chairman of the Chesterfield Tube Company, Limited. The competition was divided into five sections—steel, stores, services, tools, and stationery.

A NEW COMPANY, to be known as Imperial Chemical Industries (Pakistan), will handle the affairs of Imperial Chemical Industries, Limited, in Pakistan as from August 1. The company will be concerned mainly with the distribution of products made by I.C.I. in the United Kingdom, but will also act as the selling agent for other manufacturers.

WORK IS WELL IN HAND on the construction of a shipbuilding berth capable of accommodating vessels of more than 26,000 tons dw. at the yard of Sir James Laing & Sons, Limited, Sunderland. It will be the biggest berth on the Wear. The first ship to be constructed at the new berth will be a 18,000-ton tanker, followed by a 26,400-ton vessel for Norway.

THE STEAMER OAKLAND recently discharged a cargo of 10,037 tons of iron ore at Newport in a net working time of 36¼ hrs. This made an average rate of discharge of 273 tons per hr. Unloading began at 18.15 hrs. and was completed at 13.30 hrs. four days later. A new port record was set up on the first day, when 5,703 tons of iron ore were discharged.

W. & T. AVERY, LIMITED, of the Soho Foundry, have so far committed £950,000 on their new iron foundry at Tame Bridge, Walsall. Sir Walford H. Turner, the chairman, told shareholders at the annual general meeting on July 29. The site of 81 acres has been purchased and contracts placed for the necessary works. It will be remembered that this project was envisaged some considerable time previously.

A PARTY of 100 American foundrymen and their ladies is expected to participate in the forthcoming international conference to be held in Paris next year from September 20 to 27. The delegation will be headed by Mr. L. N. Shannon, the president of the International Committee of Foundry Technical Association. This country is to be included in either the pre- or post-congress tours, probably the former.

ACCORDING TO *Materials and Methods*, Nylon is being used in American foundries to prevent the erosion of aluminium coreboxes caused by blowing sand into the boxes. When the two halves of a corebox are put together, core-sand is forced into the box under air pressure through holes in the top. The sand erodes unprotected metal around the holes and at points where the sand hits the box inside. Nylon bushings at the corebox blow-holes and Nylon strike pads at the spots of greatest wear in the corebox castings proved the solution.

AN INDUSTRIAL DISPUTES TRIBUNAL, on July 29, found in favour of the employers in an issue involving the Ionic Plating Company, Limited, Winson Green, Birmingham (a subsidiary of Guest, Keen & Nettlefolds, Limited), and their employees. The dispute was whether an increase of minimum rates in the metal-finishing industry enforced automatically an all-round increase to all workers, whatever their earnings, or applied only to those whose existing rates were below the new minimum. The tribunal, which decided that the increase applied only to those below the new minimum, found that the company had applied those wages increases provided in the agreement made in January, 1952, between the Metal Finishing Association and the joint trades union committee.

SMITH & WELLSTOOD, LIMITED, at Bonnybridge, have just begun the first of their five-day apprentices' introductory courses. The programme started off in the training centre with an outline of the course being given by Mr. R. F. T. Paterson, apprentice supervisor. This was followed by a welcome by Mr. J. Leith, works manager. Two film strips, entitled "Our Works" and "Casting in Iron" were shown. Apprentices were conducted round the factory departments, Mr. J. Teeling Smith, foundry manager, and Mr. H. McIntyre, production controller, acting as guides. After an introduction to works processes and procedures on the second and third days, on the fourth day there was a talk on casting, accompanied by a film, given by Mr. W. Wright, foreman moulder with Mitchell Russell & Company, and also a moulding demonstration by Mr. R. Stirling, moulding instructor. On the fifth day, Mr. Paterson gave a talk on "Who's Who" and the apprentices were taken round the works to meet the various foremen, who explained the work done in their departments. Apprentices were then conducted over the works of Mitchell Russell & Company's Chattan Foundry, with Mr. J. Beattie, enamelling shop, and Mr. W. Crane, shipping department, as guides. The valedictory talk was given in the director's office by Mr. T. Preston, works director, on "Final Advice."

Raw Material Markets

Iron and Steel

Production of castings at many foundries continues to be at a standstill because of annual holidays. As is customary at such times, however, repairs to plant, relining of cupolas, and reconstruction work are being carried out where necesary. Some units, too, have arranged to take in deliveries of raw materials during the recess. Foundrymen are now more hopeful of receiving improved supplies of pig-iron. The bulk of the output from the new blast furnaces is going to the steelworks and it is expected that this will enable producers of the foundry grades of pig-iron to offer more regular deliveries.

There is no sign of any appreciable falling-aff in the demands for castings from the engineering and speciality foundries, and they are able to take up all the pig-iron which the furnaces can supply in the low- and medium-phosphorus grades, hematite, and the refined descriptions. None of these irons is available in sufficient tonnages fully to satisfy present demands. Although there is a slight decline in forward busines for light castings, most of the light and jobbing foundries have good order-books, and many of these foundries are endeavouring to acquire increased quantities of high-phosphorus pig-iron.

The supply of scrap remains a difficulty; the heavier and better grades are scarce, thus entailing the use of larger quantities of pig-iron. Foundry coke is received in sufficient quantities to meet current needs, but there is still little to spare for the accumulation of stocks. Ganister, limestone, and firebricks are readily available.

The recent improved supplies of Continental steel semis have been of considerable help to the re-rollers, who are, however, in need of still larger supplies. Little extra help can be expected from home steelworks at present. The settlement of the American steel strike should soon result in larger supplies coming from the other side of the Atlantic. Although the decline in export busines has resulted in reduced outlets for re-rollers' products, they have still plenty of work on hand, including supplies for some oversea markets. The sheet re-rollers have also fared better in deliveries of sheet bars from abroad. They have heavy commitments for both black and galvanized sheets for many months ahead, and pressure is sustained on home steelworks for supplies of sheet bars and slabs.

Non-ferrous Metals

The big news last week was, of course, the Government's announcement that the importation of foreign pig-lead would be handed back to private enterprise at the earliest possible moment, probably on October 1, when it was hoped that the Metal Exchange would be ready to reopen for trading in lead. While it had been hoped that there was a chance of a reopening this year, the stress laid on the difficulties accruing from the balance of payments situation made it appear that some long time might well elapse before anything could be done. The announcement therefore came as something of a surprise to the market, but let it be said that it was a very welcome shock, such as it was. It now remains to iron out the difficulties that are bound to arise and there will, of course, be discussions between the Ministry of Materials and the trade. The Metal Exchange Committee is understood to be giving consideration to revision of the standard contract for dealing in lead and there seems to be quite a good chance of making a start on October 1.

Meanwhile, business in lead is not likely to be very brisk and consumers will probably buy on a hand-to-mouth basis. At the present price of the metal, £131, there is room for a considerable fall, since on the Continent users are paying no more than £115. Opinions vary, but most people seem to think that the market will open below that—possibly around £105. It must be admitted that lead consumption in the U.K. is not what it was, and it may well be doubted whether pre-war figures of usage will ever again be achieved.

The anticipated statement about copper came last Friday when a drop of £2 to £285 was announced by the Ministry of Materials. This was somewhat unexpected inasmuch as the trend of the American quotation has been upwards, and many people felt that the producers would not be willing to continue to sell below that level. However, in the event agreement was reached on the basis of 33¼ cents, or about 25 points below the previous level. This new price is to continue through August, and, since it is subject to 15 days' notice by either of the contracting parties, it will, in fact, be mid-September before any further change is made. In all the circumstances, and bearing in mind that U.S. consumers have been buying Chilean copper pretty freely at around 36 cents, this new deal must be regarded as satisfactory.

News that the U.K. Government has now already completed its purchase of 20,000 tons of tin for American account brought weakness to the London market. Substantial falls in prices have occurred.

Official tin prices on the London Metal Exchange were:—

Cash—Thursday, £963 10s. to £964; Friday, £956 to £956 10s.; Tuesday, £942 to £943; Wednesday, £930 to £932.

Three Months—Thursday, £963 to £963 10s.; Friday, £955 10s. to £956; Tuesday, £943 to £944; Wednesday, £930 to £932.

New Catalogues

Insulating Bricks. General Refractories Limited, Genefax House, Sheffield, 10, have just issued a leaflet detailing the physical properties of four grades of the "Amberlite" brand of insulating bricks, three of which are based on vermiculite. It constitutes a very useful publication.

Permanent Magnet Equipment. — Rapid Magnetic Machines, Limited, of Lombard Street, Birmingham 12, have sent us two fresh catalogues (No. 122 and 134), the first, a four-page leaflet, covers the chute type of separators such as is used in the vitreous enamelling mill room. The second one, an eight-page nicely-illustrated leaflet, demonstrates the wider industrial use of magnetic equipment. Technical data are included.

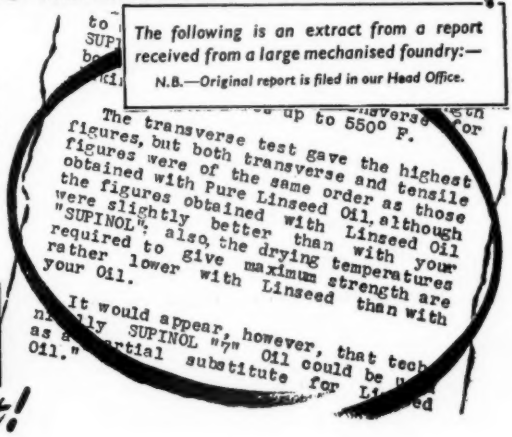
Moorings and Buoys. Matters nautical share with the railways the power of evoking the intense interest of the general run of the population. Full advantage has been taken of this fact by Brown, Lenox & Company, Limited, of Pontypridd, Glamorgan, for in the production of a brochure designed for publicizing the various items they manufacture for use in and about harbours, they have just focused attention upon the subject of buoys and moorings. Moreover, this has been done so well that the reader becomes quite fascinated with the story. The climax is reached with a central double-page "spread" of a black map of the world set in a cobalt-blue ocean, with the various moorings which have been equipped by this firm shown as white dots. The reviewer esteems this to be the finest brochure so far evolved by the British foundry industry.

If saving costs is Important — then this surely is an **IMPORTANT DEVELOPMENT!**

Since the introduction of our SUPINOL "7" Core Oil to a number of foundries — the reports from these foundries leave no doubt that this oil is equal in performance to the best on the market, and it shows a saving of 20% or more in cost. *There are no snags—no need to change from your present method of application—*

The following is an extract from a report received from a large mechanised foundry:—

N.B.—Original report is filed in our Head Office.



The transverse test gave the highest figures, but both transverse and tensile figures were of the same order as those obtained with Pure Linseed Oil, although the figures obtained with Linseed Oil were slightly better than with your "SUPINOL", also the drying temperatures required to give maximum strength are rather lower with Linseed than with your Oil.

It would appear, however, that tech... SUPINOL "7" Oil could be ... as a ...tial substitute for Li...ed Oil."

SUPINOL 7 CORE OIL

it will pay you to try it out!

Manufactured by :—

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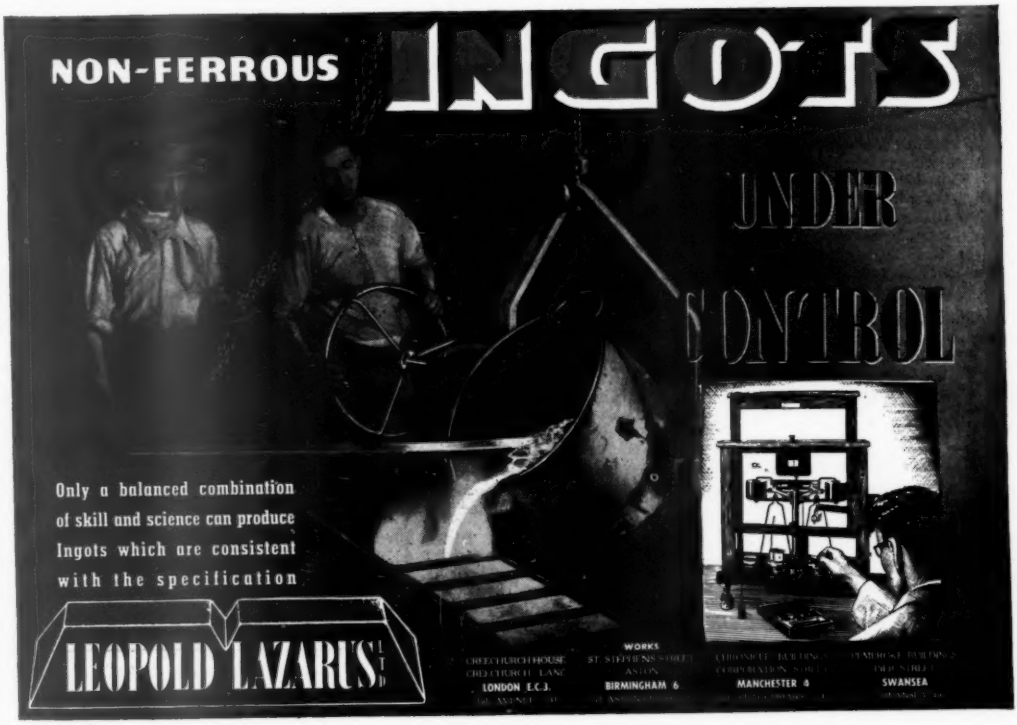

Only a balanced combination of skill and science can produce Ingots which are consistent with the specification

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WORKS

LONDON E.C.3. BIRMINGHAM 6 MANCHESTER 8 SWANSEA

Current Prices of Iron, Steel, and Non-ferrous Metals

(Delivered, unless otherwise stated)

August 6, 1952

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2:—Middlesbrough, £13 1s. 6d.; Birmingham, £12 15s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £13 17s. 6d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent P, up to 3 per cent. S), d/d within 60 miles of Stafford, £15 5s. 9d.

Scotch Iron.—No. 3 foundry, £14 4s. 6d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £17 4s. 6d.; South Zone, £17 7s.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £17 14s. 6d.; South Zone, £17 17s.

Cold Blast.—South Staffs, £18 7s.

Hematite.—Si up to 2½ per cent., S. & P. over 0.03 to 0.05 per cent.:—N.-E. Coast and N.-W. Coast of England, £13 11s. 6d.; Scotland (Scotch iron), £13 18s.; Sheffield, £14 9s. 6d.; Birmingham, £14 17s. 6d.; Wales (Welsh iron), £13 18s.

Basic Pig-iron.—£12 10s. all districts.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered.)

Ferro-silicon (6-ton lots).—40/55 per cent., £57 10s., basis 45% Si, scale 21s. 6d. per unit; 70/84 per cent., £86, basis 75% Si, scale 23s. per unit.

Ferro-vanadium.—50/60 per cent., 22s. per lb. of V.

Ferro-molybdenum.—65/75 per cent., carbon-free, 10s. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, £204; ditto, copper-free, £212.

Ferro-tungsten.—80/85 per cent., 28s. 7d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 31s. 7d. per lb. of W.

Ferro-chrome (6-ton lots).—4/6 per cent. C, £85 4s., basis 60% Cr, scale 28s. 3d. per unit; 6/8 per cent. C, £80 17s., basis 60% Cr, scale 26s. 9d. per unit; max. 2 per cent. C, 2s. per lb. Cr; max. 1 per cent. C, 2s. 2½d. per lb. Cr; max. 0.15 per cent. C, 2s. 3½d. per lb. Cr; max. 0.10 per cent. C, 2s. 3¾d. per lb. Cr.: max. 0.06 per cent. C, 2s. 4d. per lb. Cr.

Cobalt.—98/99 per cent., 20s. per lb.

Metallic Chromium.—98/99 per cent., 6s. 5d. to 6s. 9d. per lb.

Ferro-manganese (blast-furnace). — 78 per cent., £43 15s. 2d.

Metallic Manganese.—93/95 per cent., carbon-free, £262 per ton.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft, u.t., £25 4s. 6d.; tested, 0.08 to 0.25 per cent. C (100-ton lots), £25 14s. 6d.; hard (0.42 to 0.60 per cent. C), £27 12s.; silico-manganese, £33 8s.; free-cutting, £28 8s. 6d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £31 9s.; case-hardening, £31 17s.; silico-manganese, £34 9s. 6d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £29 8s.; basic, hard, over 0.41 up to 0.60 per cent. C, £30 8s.; acid, up to 0.25 per cent. C, £31 17s.

Sheet and Tinplate Bars.—£25 3s. 6d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £29 14s.; boiler plates (N.-E. Coast), £31 1s. 6d.; chequer plates (N.-E. Coast), £31 3s.; heavy joists, sections, and bars (angle basis), N.-E. Coast, £27 17s.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., untested, £31 15s. 6d.; flats, 5 in. wide and under, £31 15s. 6d.; hoop and strip, £32 10s. 6d.; black sheets, 17/20 g., £40 12s. 6d.; galvanized corrugated sheets, 17/20 g., £54 4s.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £50 18s. 3d.; nickel-chrome, £71 6s. 9d.; nickel-chrome-molybdenum, £78 14s.

Tinplates.—57s. 1½d. per basis box.

NON-FERROUS METALS

Copper.—Electrolytic, £285; high-grade fire-refined, £284 10s.; fire-refined of not less than 99.7 per cent., £284; ditto, 99.2 per cent., £283 10s.; black hot-rolled wire rods, £294 12s. 6d.

Tin.—Cash, £930 to £932; three months, £930 to £932; settlement, £931

Zinc.—G.O.B. (foreign) (duty paid), £130; ditto (domestic), £130; "Prime Western," £130; electrolytic, £134; not less than 99.99 per cent., £136.

Lead.—Good soft pig-lead (foreign) (duty paid), £131; ditto (Empire and domestic), £131; "English," £132 10s.

Zinc Sheets, etc.—Sheets, 15g. and thicker, all English destinations, £150 15s.; rolled zinc (boiler plates), all English destinations, £148 15s.; zinc oxide (Red Seal), d/d buyers' premises, £151.

Other Metals.—Aluminium, ingots, £157; magnesium, ingots, 2s. 10½d. per lb.; antimony, English, 99 per cent., £225; quicksilver, ex warehouse, £65; nickel, £454.

Brass.—Solid-drawn tubes, 27⅝d. per lb.; rods, drawn, 37⅝d.; sheets to 10 w.g., 31⅞d.; wire, 33½d.; rolled metal, 30½d.

Copper Tubes, etc.—Solid-drawn tubes, 32⅝d. per lb.; wire, 320s. per cwt. basis; 20 s.w.g., 348s. 6d. per cwt.

Gunmetal.—Ingots to BS. 1400—LG2—1 (85/5/5/5), £220 to £270; BS. 1400—LG3—1 (86/7/5/2), £245 to £280; BS. 1400—G1—1 (88/10/2), £352 to £400; Admiralty GM (88/10/2), virgin quality, £375 to £380 per ton, delivered.

Phosphor-bronze Ingots.—P.Bl, £365 to £425; L.P.Bl, £290 to £335 per ton.

Phosphor Bronze.—Strip, 44½d. per lb.; sheets to 10 w.g., 46½d.; wire, 49½d.; rods, 45d.; tubes, 43½d.; chill cast bars: solids 4s. 5d., cored 4s. 6d. (C. CLIFFORD & SON, LIMITED.)

Nickel Silver, etc.—Ingots for raising, 2s. 9¾d. per lb.(7%) to 3s. 10½d. (30%); rolled metal, 3 in. to 9 in. wide × .056, 3s. 3¾d. (7%) to 4s. 4½d. (30%); to 12 in. wide × .056, 3s. 4d. to 4s. 4¾d.; to 25 in. wide × .056, 3s. 6d. to 4s. 6¾d. Spoon and fork metal, unsheared, 3s. 0¾d. to 4s. 1½d. Wire, 10g., in coils, 3s. 10½d. (10%) to 4s. 10½d. (30%). Special quality turning rod, 10%, 3s. 9½d.; 15%, 4s. 2½d.; 18%, 4s. 6½d. All prices are net.

Protection of Wages

The International Labour Organization's 1949 convention on the protection of wages comes into force on September 24 next. It was ratified by the United Kingdom last September, and the first annual report is due to be made by the British Government in October, 1953.

The convention is designed to ensure that workers shall receive the full benefit of their wages and to protect them from certain abuses. It deals with such matters as the payment of wages in legal tender, regulation of payment in kind, payment of wages direct to the worker, freedom of the worker to dispose of his wages, protection of the workers from coercion to use works' stores for the sale of commodities or other services provided by the undertaking, regulation of the conditions under which deductions may be made from wages, regulation of the attachment of wages and their protection in cases where the undertaking becomes bankrupt, regular payment of wages, and prohibition of payment in taverns.

The provisions of the convention to be applied are those contained in Articles 3 to 15, which deal, broadly speaking, with the subject matter of the Truck Acts. The law of the United Kingdom is in accordance with the provisions of the convention so far as workers other than non-manual and domestic workers are concerned. The legislation dealing with these matters does not apply to non-manual or domestic workers, and in the circumstances it is proposed to exclude these categories of workers from the application of the convention.

MR. WILLIAM BLAKEY has been appointed director of chemical research of British Industrial Plastics, Limited.

Death of Sir William Griffiths

Formerly chairman and managing director of the Mond Nickel Company, Limited, Sir William Thomas Griffiths died on Tuesday of last week at the age of 57. Sir William was educated at Howard Gardens School and University College, Cardiff. After service with the Royal Engineers in France from 1915 to 1918 he was appointed a research metallurgist at Woolwich, where he remained until 1926. In that year he joined the Mond Nickel Company. From 1928 to 1945, as manager of the company's research and development department, Sir William was responsible for the development of many new uses of nickel. In August, 1945, he was appointed chairman and managing director of the company in succession to the late Mr. D. Owen Evans, M.P., and later in the same year was appointed a vice-president, in charge of the operations and activities in Europe and other parts of the world outside the American continent of the International Nickel Company of Canada, Limited. He resigned his appointment with the Mond Nickel Company at the end of 1950.

President of the Institute of Metals from 1944 to 1946, Sir William had served on the councils of the British Non-Ferrous Metals Research Association, the British Cast Iron Research Association, the British Iron and Steel Research Association, and the Iron and Steel Institute, and as a member of the grand council of the Federation of British Industries. In 1947 he became a member of the advisory council of the Department of Scientific and Industrial Research.

DUNDEE, August 11—A portable air compressor, for the Corporation Waterworks. The Town Clerk, City Chambers, Dundee.

LOW PHOSPHORUS
REFINED & CYLINDER
HEMATITE
MALLEABLE
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NORTHAMPTONSHIRE
SWEDISH CHARCOAL

PIG-IRON

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FERRO SILICON 12/14%
ALLOYS & BRIQUETTES
N.F. METALS & ALLOYS
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LIVERPOOL, 2. 13, Rumford St., Central 1558
GLASGOW, C.2. 93, Hope Street, Central 9969

CLASSIFIED ADVERTISEMENTS

PREPAID RATES: Twenty words for 5s. (minimum charge) and 2d. per word thereafter. Box Numbers, 2s. extra (including postage of replies).

Advertisements (accompanied by a remittance) and replies to Box Numbers should be addressed to the Advertisement Manager, Foundry Trade Journal, 49, Wellington Street, London, W.C.2. If received by first post Tuesday advertisements can normally be accommodated in the following Thursday's issue.

SITUATIONS WANTED

FOUNDRY MANAGER (45), A.M.I.B.F. Fully and semi-mechanised plants, light engineering (5 cwt.). Cupola, sand, patternshop control. Sandslingers, grey iron and non-ferrous. Gravity die. Keen, active. Progressive outlook. Housing accommodation essential. Services available now.—Box 1921, FOUNDRY TRADE JOURNAL.

KEEN hardworking Indian (28) B.Met., A.M.I.Brit.F. Completed Diploma Course National Foundry College, seeks permanent situation as Technical Assistant or Metallurgist; 4½ years' Foundry experience Mechanised Grey Iron Foundry in India.—Box 1972, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 inclusive or a woman aged 18-59 inclusive unless he or she, or the employment, is excepted from the provisions of the Notification of Vacancies Order 1952

THE CONSTRUCTIONAL ENGINEERING CO., LTD., Titan Works, Birmingham, 12, invite applications for the position of SALES MANAGER for their Foundry Plant and Equipment.—Replies, including full details of experience, age, and salary expected, should be addressed to the MANAGING DIRECTOR, marked "Personal."

PATTERN MAKER. Vacancy for one experienced man capable of making Master Patterns and setting up intricate metal patterns. Permanent situation, advancement and experience in a modern, well equipped shop. Modern flat available for suitable applicant.—G. PERRY & SONS LIMITED, Hall Lane, Leicester.

FIRST-CLASS IRON FOUNDRY FOREMAN required for a progressive Engineering concern in the North Staffs area. Successful applicant would be responsible from stock yard to finished casting, in a jobbing foundry, employing 40 personnel, manufacturing all types of green and dry sand castings up to 6 tons. Must be a keen disciplinarian and capable of setting piecework prices. Excellent conditions and salary to the right man.—Write, with fullest details, to Box 1962, FOUNDRY TRADE JOURNAL.

A LIAISON OFFICER is required for a heavy Engineering Company which uses a large variety of steel and iron castings. The successful applicant must be capable of making investigations and giving advice to the drawing office, which will (*a*) lead to the simplification of pattern construction and moulding procedure, and (*b*) obviate points in design which might cause unsoundness and defects.—Applications, stating age, experience and salary required, to be addressed to Box 1957, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT—*Contd.*

CORE SHOP CHARGEHAND required for repetition Foundry in Midlands area.—Write, stating age, full experience, and salary required, Box 1960, FOUNDRY TRADE JOURNAL.

REQUIRED.—DRAUGHTSMEN, with experience of gravity diecastings.—JOHN DALE, LTD., London Colney, St. Albans, Herts. Bowmansgreen 2266.

CHARGEHAND MOULDER wanted. Fully experienced moulder, able to control labour and produce results on semi-jobbing work. Position will be a permanent one to the right man, and offers good prospects.—Box 1959, FOUNDRY TRADE JOURNAL.

CATTON & COMPANY LIMITED, Steel Founders, have a vacancy for a Metallurgical or Science Graduate. The position is one which holds considerable prospects for the type of person who is prepared to develop a career in the Steel Foundry Industry. Complete details to CATTON & COMPANY LIMITED, Steel Founders, Hunslet, Leeds 10.

PATTERNMAKER, first-class, required by large Foundry—in Republic of Ireland—producing high quality domestic appliances. Must be experienced in Plaster, Lead and Tin and Wood pattern equipment for both machine and floor moulding. The position offers scope and variety, together with good salary, for keen man. House available for successful applicant.—Write in first instance, giving particulars of experience, etc., to Box 1968, FOUNDRY TRADE JOURNAL.

WANTED.— First-class FOREMAN PATTERNMAKER for Foundry in the South of England engaged in the production of Engineers' Castings, both mechanised and jobbing work.—Applicants should give full details of past experience, present position, age, salary required, references, etc., in confidence, to EAST SUSSEX ENGINEERING CO., LTD., Phoenix Ironworks, Lewes, Sussex.

NEWLY formed Research Organisation, with headquarters in Birmingham, requires the services of a TECHNICAL SECRETARY to co-ordinate its work. Although duties will be largely Secretarial and Administrative, applicants must have engineering and metallurgical qualifications in Iron and Steel. Position would be for a preliminary period of one year, but would be permanent if satisfactory results achieved. Salary according to experience and qualifications.—Apply to: "Research," PEAT, MARWICK, MITCHELL & CO., Lombard House, Great Charles Street, Birmingham, 3.

FOUNDRY SUPERINTENDENT wanted for Foundry near Smethwick, Staffs. Preferably used to high duty irons, but must possess drive, energy, and the ability to get things done. This is a permanent, progressive post for the right man. Applicants should state in confidence their complete experience, together with salary required.—Box 1970, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT—*Contd.*

MANAGER required to take full control of progressive Iron Foundry in East Scotland, making general grey iron castings up to 4 tons. Good company house available. Pension scheme.—Reply, giving age, details of experience, etc., Box 772, ROBERTSON & SCOTT, Edinburgh, 2.

DIE CASTING SHOP SUPERINTENDENT required. Experienced in Gravity and Pressure Die Casting, principally for Aluminium Alloys, also a knowledge of Die design is desirable. Good working conditions. Prospects for the right man.—Apply to the Personnel Manager, KENT ALLOYS LIMITED, Rochester, Kent.

JUNIOR ASSISTANT FOUNDRY METALLURGIST, preferably with some foundry experience; interesting and practical job; profit sharing scheme; good conditions; state age, qualifications, experience, and salary required.—Apply Managing Director, MILLER & COMPANY, LIMITED, London Road Foundry, Edinburgh, 7.

FOUNDRY MANAGER required for large South Wales Foundry, specialising in non-ferrous metals. Applicants must have large experience in Manganese and Aluminium Bronze Castings up to 3 tons. State full particulars of experience and salary required.—Box 1958, FOUNDRY TRADE JOURNAL.

FOUNDRY ENGINEERS.—The International Meehanite Metal Co., Ltd., 66, Victoria Street, London, S.W.1, have vacancies for positions of Foundry Engineer. Principal qualifications are drawing office, design and workshop experience. Knowledge of grey iron metallurgical and foundry practice. These positions offer exceptional opportunities of advancement to enterprising and adaptable men. Wide scope of operation. Knowledge of a foreign language desirable. Willingness to travel in Europe essential. State full details of experience, technical education, age, etc.

PATENT

THE Proprietor of British Patent No. 577682, entitled "Improvements in furnace construction," offers same for licence or otherwise to ensure practical working in Great Britain.—Inquiries to SINGER, STERN & CARLBERG, 14, East Jackson Boulevard, Chicago 4, Illinois, U.S.A.

MACHINERY WANTED

WANTED.

FOUNDRY MACHINERY, every description, including Moulding Machines, Sand Mills and Mixers, Cupolas, Furnaces, Cranes; also Machine Tools, etc.

Temporary Office Address:
S. C. BILSBY, A.M.I.C.E., A.M.I.E.E., 8b, Birmingham Street, Oldbury, near Birmingham. Broadwell 1359.